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Marine Engineering and Shipping Age

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A Call for Action

THERE are on the horizon unmistakable signs of the dawn of day of a real American merchant marine.

The attitude of the next Congress will be favorable to some plan, as yet undeveloped, that will make possible the establishment of a merchant marine consistent with the demands of the nation. The situation has so far changed that even some who have heretofore opposed any semblance of a subsidy are now ready to give ear to those who favor that course; but it is questionable if relief should now take that form. Again, the tentative program contemplates close cooperation with the Shipping Board instead of the antagonism of the past; and while the outcome may mean continued operation by the Government for a while instead of immediate restoration to private interests, nevertheless, the day of private ownership would be hastened rather than retarded by substantial help from the Government; while in the interim our shipyards would be given the work that they so badly need for resuscitation.

And as to the President, Mr. Coolidge has consistently favored a merchant marine; and his present attitude with respect to an efficient Navy, both in vessels and personnel, but lends encouragement to the belief that he will heartily endorse any sensible program that The Congress may evolve. Then, too, the Secretary of Commerce, whose department is much concerned, may be counted on to actively support any move that may be headed in the right direction.

The time is now ripe, therefore, for all Americans engaged in designing, building, repairing and operating ships, to note the trend and resolve to follow it vigorously by both individual and concerted action at the psychological moment—the opening of the next Congress.

For our part, MARINE ENGINEERING AND SHIPPING AGE may be depended upon to live up to the motto of its publishers—"be a motor, not a trailer."

Thirty-Knot Liners

THE recent proposal to establish a line of very fast passenger and mail ships between Montauk Point and Europe is highly reminiscent as similar proposals have appeared from time to time in the past but have never got by the "talking" stage. That 30-knot ships, sailing from Montauk, would enable the voyager to make better time across the Atlantic than ships of the same speed sailing from New York goes without saying, but while the general idea may, readily enough, be admitted as sound the working out of this idea to the point of a practical and actual reality would, to put it mildly, be a tremendous undertaking; one which could not conceivably be embarked upon by private individuals without definite guarantees of governmental assistance and financial support.

Passing by, for the moment, the financial aspects of the scheme the proposals which have been outlined in the daily press insofar as they relate to the type and amount of service contemplated are interesting, if a bit staggering. In brief, it is proposed to maintain daily sailings from Montauk to Europe and return, using a fleet of very high speed vessels, apparently 30 knots or better, the ships being run in connection with a special express train service to Montauk Point from New York over the Long Island Railroad. Furthermore, it is stated that the proposed ships will be equipped with complete flying decks and that passengers so desiring will be able to board the ship by aeroplane a day after she has sailed or to leave her, in the same way, a day before she arrives at her destination. The flying decks would make possible the conversion of the vessels to actual naval plane carriers in a very short period of time.

In favor of the scheme there is primarily the modern and apparently never fully satisfied desire of a certain proportion of the traveling public for great speed. Secondly the fact that such a line of ships would undoubtedly furnish the quickest possible means of transportation for mails

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and express service would undoubtedly bring to them the lion's share of this class of business. Finally the vessels would be immediately available as naval auxiliaries of the utmost value.

Against the proposition is, first, the enormous capital expenditure involved. To maintain a daily service, east and west, 10 ships would be required. The ships themselves might easily run by 15 million dollars each, which means a fixed overhead of not less than $120,000 a year for interest and insurance alone that must be met out of the operating income; and when the extensive terminals required and the changes and additions to the railway service which would undoubtedly have to be made are also considered, it would seem that the total investment might well approach the neighborhood of 200 million dollars. The income derived from the operation of such a fleet of ships is entirely problematical. The total passenger accommodation of each ship is reported to be 400 so that the passenger revenue would need to be augmented by a liberal mail or other subsidy if the heavy operating costs and maintenance, insurance and depreciation charges are to be fully met. Passenger rates would have to be high and it seems doubtful if a sufficient number of travelers, willing to pay the price, could daily be found to anywhere near fill up even the limited accommodation afforded. Furthermore, speed will have to be the main inducement to the traveler as nothing approaching the space and luxury afforded by vessels of the *Leviathan* and *Majestic* class will be found on a 30-knot ship of the cruiser or plane carrier type. To maintain any such sea speed in an 800-foot ship will require machinery spaces proportionately far in excess of those found on the present large 24-knot liners and a general arrangement of passenger accommodations in which, while a fair degree of comfort may be assured, extensive and luxurious public rooms, swimming tanks and the other usual accessories of the modern first class liner will be found wanting.

Finally there is an international aspect to the proposition which cannot be overlooked. Apparently the ships, as at present contemplated, are in effect naval plane carriers with a limited amount of passenger accommodation added. The status of this class of ship was determined by the Washington Conference in 1921 and it seems at least doubtful if the government could, under these circumstances, see its way clear to aid the financing of such a fleet, even if it were, ostensibly, under private ownership and control.

The actual design of such vessels is a problem of the greatest and most absorbing interest, calling into play the utmost skill of both naval architect and engineer. That they could be successfully built in American shipyards, there is no doubt; but all this is but a part of the problem. As at present outlined, the proposal seems, for many reasons, impractical and likely to follow its several predecessors into oblivion, although it is apparently receiving more serious consideration and has given rise to a wider discussion than has, in the past, been accorded to similar proposals. With certain modifications, which would make the service comparable with occasional fast trains on our trunk line railways, it might be made to work.

The Fleet Corporation Reorganization

CHANGES in personnel and in the assignment of duties to the various officials of the Shipping Board and the Fleet Corporation have occurred so frequently that they have come to be looked upon by the general public as matters of course—in fact inherent to the system and methods by which the shipping policy of the government is shaped and its fleet of vessels controlled.

While these changes have, in themselves, been for the most part unimportant and worthy of but passing notice, they have come so constantly that their effect, in the aggregate, has been most prejudicial to the conduct and standing of the government's shipping business. Nothing can be so productive of inefficiency, lack of confidence and general disorganization in a commercial undertaking as constant change, either of personnel or methods; and it is essentially a commercial undertaking which the Shipping Board and Fleet Corporation are trying to run.

Changes in personnel have frequently been followed by changes in method; but, as has already been remarked, while serving to keep alive a feeling of irritation and unrest, these have not usually been of individual importance. The latest proposal does, however, appear to rise above its predecessors and to be a matter which has a very vital bearing upon the operations of the Fleet Corporation and is certain to have a far-reaching effect upon the conduct of its business.

If the government is to continue in the shipping business (and this latest reorganization seems to indicate that it proposes so to do), nothing is more certain than that the department having charge of the operation of its vessels should, if the efficiency of private management is to be approached, be modeled as nearly as possible after those of large and successful private organizations. In combining the Shipping Board and Fleet Corporation in such manner that the former becomes, in fact, the board of directors of the latter, a step is taken in the direction of well proved and universally accepted corporative management—at least insofar as outward appearance is concerned. That the inside working of the new arrangement will, in any great degree, simulate that of an active, aggressive and thoroughly efficient private corporation, we fear there is grave reason to doubt.

The Shipping Board is essentially a regional and political body; furthermore, it has many duties to perform which are only remotely connected with the actual operation of its vessels. If the board can divorce political bias from its directoral functions; if it can really work with and not entirely as dictator to the executive officer of the Fleet Corporation, then indeed there might be a very reasonable hope for stability and continuity of purpose in the Fleet Corporation. However, if past records are to be taken as an indication of future events, it is safe to say that it will do nothing of the kind. Under the law the Shipping Board is so constituted that it cannot function properly in any practical commercial capacity. No matter what may be the individual ability and singleness of purpose of its individual members, they cannot act together as an efficient executive board. Anyway, certainly they never have,

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and there seems to be no reasonable grounds for expecting that they ever will. All that can be hoped for from this latest reorganization is the elimination of some part of the friction which, without exception, has in the past eventually developed between each successive head of the Fleet Corporation and the Shipping Board.

The running of the government vessels is an enormous undertaking. One can but trust that the board, in its new capacity as directors, will fully realize the seriousness of the task imposed upon it and that its future efforts will at least tend towards stability of purpose and an honest recognition and support of those actually responsible for the upkeep and operation of its fleet. As matters stand at the moment, the board acts almost wholly on its own responsibility, there being substantially no contact between it and the Fleet Corporation than that demanded by reports from the latter, confined largely to masses of figures. When it comes to selling ships and routes, the Fleet Corporation is a nonentity—or at least has been for some time past.

The Malolo

THE advent of a great and luxurious passenger liner will always be a matter of interest notwithstanding the fact that the development of ocean travel has, during the past few years, made such vessels the rule rather than the exception in important overseas passenger services. While, until very recently, there has been no attempt to exceed the speed of the *Mauretania,* built 20 years ago, there appears to be no limit, in recent vessels, of the extent to which thought and expense have been devoted to increasing the safety, comfort and luxury in which the passengers are carried. If older vessels could be fairly well relied upon to safely transport their passengers, there was, on the one hand, an ever-present risk from possible collision or breakdown and the necessity of often depending on dead reckoning alone in thick weather, and on the other, except for those who could afford the luxury of the very limited amount of special accommodation available, a certain amount of personal discomfort and inconvenience which was accepted by the average passenger as inherent to ocean travel.

In the modern first class ocean passenger ship, risk of safety has very nearly been eliminated and discomfort and the necessity of accommodating oneself to strange, limited and often inconvenient and uncomfortable surroundings is a thing of the past. Twin screws, watertight subdivision, radio, submarine signals, gyro compasses, to mention but a few of the devices which have been generally adopted, have forced the "perils of the sea" far into the background while elaborate furnishings, beds replacing berths, hot and cold running water, private bath rooms, swimming baths, gymnasiums and beautifully appointed public rooms give to the voyager a sense of comfort and luxury which, more often than not, is lacking in his own home.

It is a pleasant, if quite novel, experience to be able to describe an American vessel as the latest and most completely appointed passenger liner. Certain it is that no commercial vessel built in this country, with the possible exception of the *St. Louis* and *St. Paul,* over 30 years ago, has aroused the interest and curiosity accorded the new *Malolo* and it is with a feeling of the greatest satisfaction that one can assure those who are fortunate enough to satisfy this curiosity by a personal inspection that they will find a vessel which, in the insurance of safety, comfort and convenience to her passengers, has few if any equals and certainly no superiors. If the overwhelming and bizarre decorations found on certain recent Atlantic ships is sought, the visitor to the *Malolo* will be disappointed, for it is, happily we think, not in evidence; but if real and material luxury is looked for, the personal and actual kind which makes of sea travel a comfort as well as an adventure, it will be found to an extent and in a manner which places the *Malolo* quite in a class by herself. Every broad demand upon hull construction, accommodation, equipment and machinery, has been carefully met; no detail, however small and apparently unimportant, has escaped careful and systematic thought and attention.

On the score of safety, the *Malolo* has, in passing through an ordeal of collision and flooding on her trial trip which few ships could have survived, proved herself. Her commercial success as a passenger carrier can be demonstrated only by experience, but in the meantime it is safe to say that no liner has ever entered upon her career upon which more care and thought and, in proportion to her size, more money has been expended in the endeavor to produce a perfect ship.

The service for which the *Malolo* has been designed and built is a very special one—to what extent it can support ships of her type we have no means of knowing, but with the steady growth of ocean passenger traffic and the constantly increasing demand for safety, comfort and luxury upon the vessels engaged in it, other *Malolo's* are bound to appear. They may not be duplicates of the original, but her main characteristics of safety and comfort are bound to be features of all coming first class liners.

Already we have the *California,* approaching completion for the intercoastal service. While a ship of different type than the *Malolo,* she is, in her way, an equally outstanding example of modern ship design and construction. We trust it is not unreasonable to expect that a way will be found whereby other first class American ocean liners may make their appearance in the near future.

Reciprocating Steam Engines and Fuel Economy

THE most recent report on world shipbuilding, issued on October 12 by Lloyd's Register of Shipping, states that on September 30 there were under construction 1,163,630 indicated horsepower of internal combustion engines, 568,969 indicated horsepower of steam reciprocating engines and 309,900 shaft horsepower of steam turbines. The total of 1,163,630 horsepower of

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heavy oil engines as compared with 878,869 for both steam engines and steam turbines is a sufficient indication of the phenomenal increase in the use of the marine Diesel engine and furnishes still further proof, if any was needed, that more extended and convincing demonstration of the much discussed possibility of improving the economy of marine steam machinery must soon be forthcoming if the total tonnage of motorships in service is not in a very few years to exceed that of steam propelled vessels.

Notwithstanding the fact that the steam reciprocating engine has practically disappeared from shore power plants in this country, and that the possibility of decreasing steam consumption in marine plants is being considered almost entirely in conjunction with a more extended use and further development of the steam turbine and its accompanying auxiliaries, the reciprocating engine still continues as the prime mover in a large majority of new steam propelled vessels as is amply demonstrated by Lloyd's statistics.

Undoubtedly it is mainly on the score of reliability that the reciprocating steam engine has so far retained its popularity among shipowners. They and their superintending and seagoing engineers are familiar with it, have absolute confidence in its power to operate continuously and with a minimum amount of attention and care over long periods, and are willing to accept somewhat higher fuel bills safe in the assurance that it is a bad breakdown indeed which prevents the chief engineer from getting power from at least one cylinder and bringing his ship safely to port.

While giving all due credit to the reciprocating steam engine for its unquestioned reliability, we believe that its continued use is very largely due to the fact that the vast majority of engineers are more familiar with it than with any other type of prime mover. The steam turbine is certainly far past the experimental stage and those who have lived with it and become accustomed to its use surely have the same confidence in its reliable and satisfactory performance that they formally accorded to the reciprocating engine. That the same confidence is being won by the internal combustion engine seems to be demonstrated by the fact of the many repeat orders which are placed by those who have had practical experience with this type of machinery. It would appear, then, that the time must surely come when the reciprocating steam engine, if it is to continue in use, must demonstrate its practical ability to operate continuously with steam at higher pressures and temperatures than is now ordinarily supplied to it—in short, to materially increase its economy of steam and fuel consumption.

In this country no very radical steps have been taken in the direction of using high pressure, high temperature steam with reciprocating engines. It is true, that pressures have gradually increased and in a few isolated cases, superheat has been employed, but in such of the latter as have come under the writer's observation the degree of superheat has been very moderate and its actual effect has been merely to guarantee a supply of perfectly dry steam to the engine; not an entirely unmixed blessing as a little moisture has quite definite lubricating properties, in the high pressure valve chest and cylinder. In Europe, on the other hand, considerable and marked progress has been made in the development of high pressure, high temperature steam engines.

Perhaps the best known of the newer type of steam engine which has been used on shipboard is the Lentz. A number of these engines are in service and something over two years ago a small vessel propelled by one of them visited New York. This ship, the *Fritz Schoop*,* is propelled by a double compound engine with poppet valves operating on steam at 206 pounds pressure and over 200 degrees superheat. Incidentally, it appears doubtful if this reported high superheat is actually maintained in service as the piping arrangement indicated that the auxiliaries were supplied with the same steam as the main engine—and the average auxiliary does not thrive on 200 degrees superheat. However this may be, the *Schoop's* engines were reported to indicate 800 horsepower with a corresponding coal consumption of 1.11 pounds per horsepower hour for the main engines alone and 1.43 pounds for all purposes, truly remarkable results. A principal difficulty in the use of superheated steam in reciprocating engines is valve lubrication, a particularly serious matter when watertube boilers are employed. In the Lentz engine this problem is apparently satisfactorily solved by the poppet valves. In the case of the *Fritz Schoop*, the economy attained was not, however, entirely due to superheat, as special condensing apparatus and feed heaters were fitted, which undoubtedly contributed substantially to the final results obtained.

More recently two reciprocating-engined vessels, one in service, the other just launched, in which high pressure, high temperature steam is or is to be used, have attracted attention on the other side of the Atlantic. The first of these vessels, the *Borneo*, a Dutch steamer, was originally equipped with ordinary reciprocating engines of 3,800 indicated horsepower. These have now been converted, by the Werkspoor Company, of Amsterdam, to use steam at 500 pounds pressure, highly superheated. No pressure approaching 500 pounds has ever been used in a marine reciprocating engine, certainly not in one of such large size, and the performance of the *Borneo's* machinery in actual service is sure to be closely watched and is a matter of the greatest interest and importance to marine engineers. Following the Lentz practice, the *Borneo's* engines have poppet valves, but they are operated by hydraulic pressure, oil being employed as the actuating medium. Steam is supplied by two watertube boilers of the Hawthorn-Armstrong type, fitted with mechanical stokers. Altogether the *Borneo* marks a wide departure from the ordinary type of cargo steamer and, if her performance comes up to the expectations of the designers and builders of her present machinery, it is likely to have a material effect upon the future design of marine steam machinery. The second vessel referred to was launched recently at West Hartlepool, England, and, while not presenting any such radical departures from existing practice as the *Borneo*, nevertheless gives indications of a distinct trend in the design of steam propelling machinery. This ship, the *City of Canberra*, is a high powered cargo liner, building by William Gray & Company for the Ellerman Lines. She is designed

*See *Marine Engineering and Shipping Age* for May, 1925, page 266.

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for a sea speed of 13½ knots and will have a total deadweight capacity of about 10,800 tons. A single quadruple expansion engine is installed, supplied with steam at 265 pounds pressure and 150 degrees superheat by four Scotch boilers in which forced draft, preheated to about 300 degrees is to be used. It will be seen that, while the departures from existing practice which have been made can hardly be considered radical, their sum total is considerable and exceptional economy of fuel is expected.

The two vessels mentioned are by no means unique. Similar experiments with high pressure steam have been made from time to time in the past, but apparently with indifferent results as they have not been followed up, due possibly to the lack of satisfactory working materials. Now, however, the problem of supplying heat and pressure-resisting materials is well on the way to being solved and the advent of these new steam vessels coming at a time when the competition offered by the motorship is day by day becoming more intensive is a matter of very considerable significance.

James Swan Appointed Superintending Engineer of the New England Steamship Company

Appointment effective November 1—Mr. Swan will continue editorial work with Marine Engineering and Shipping Age as contributing editor

JAMES SWAN, editor of MARINE ENGINEERING AND SHIPPING AGE, has been appointed superintendent of marine construction of the New England Steamship Company with headquarters at Newport, R. I., effective November 1 to fill the vacancy caused by the death last month of Mr. Warren T. Berry. Mr. Swan will continue his connection with MARINE ENGINEERING AND SHIPPING AGE as a contributing editor.

James Swan

Mr. Swan was born in Boston, Mass., and is a graduate of the Massachusetts Institute of Technology, where he specialized in naval architecture and marine engineering. After graduating from the Institute in 1891 he was retained by the Institute for several years as an instructor in naval architecture. From 1896 to 1897 he was a student in naval architecture at the University of Glasgow, in Scotland, under Professor, now Sir John Biles. After finishing the course at the university he was employed for several months by Professor Biles in connection with his private practice as a naval architect.

After returning to the United States Mr. Swan was engaged for the period of the Spanish-American war in special work in naval construction at the office of Captain J. J. Woodward, U.S.N., at Newport News, Va. After the Spanish-American war he became chief of the hull scientific department of the Newport News Shipbuilding & Dry Dock Company, engaging in hull design work and estimate of construction costs. During this time he was closely associated with the design of the Pacific Mail steamers *Korea* and *Siberia*, the largest ships which up to that time had been laid down in the United States; and with the re-design of the battleship *Missouri*, which was changed from a 16-knot ship to an 18-knot ship with increased displacement. In March, 1900, he left Newport News to accept a similar position with the recently organized New York Shipbuilding Company at Camden, N. J., remaining there in various capacities for some 17 years, during the last 5 years as assistant to the president, in this capacity working with the late Mr. De Courcy May and the late Mr. Samuel M. Knox. From 1909 to 1914 a large part of his time was occupied in representing the New York Shipbuilding Company in connection with foreign contracts in Great Britain, Turkey, China, Russia and various South American countries, including Uruguay, Argentine, Peru and Chili.

In 1917 Mr. Swan left the New York Shipbuilding Company to accept the position as general manager of the Herreshoff Manufacturing Company, the celebrated yacht building firm at Bristol, R. I., where he remained during the World War and up to 1921. While at Herreshoff's he had charge of a large and varied amount of war work and subsequently of numerous fine yachts. In 1921 he became president of the Groton Iron Works, Groton, Conn., where he built a steel propeller ferry boat for the city of Boston and carried out a variety of miscellaneous small contracts

During the years 1922 and 1923 Mr. Swan was engaged on special survey and appraisal work with the United States Shipping Board, including a detailed survey of some 900 laid-up Shipping Board vessels; and it was in the fall of the latter year that he was appointed editor of MARINE ENGINEERING AND SHIPPING AGE.

Mr. Swan's work as editor of MARINE ENGINEERING

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AND SHIPPING AGE has had much to do with the increased prestige that this publication has attained in recent years; and it is with considerable satisfaction, therefore, that the publisher is able to announce Mr. Swan's continued participation as a contributing editor, to which arrangement the New England Steamship Company has so generously subscribed. His splendid technical education, unusually varied experience, and extensive acquaintanceship with men in all walks of life in the marine field, combined with a pleasing personality, and convincing ways, were the factors which made him a thoroughly good editor; and it is those same splendid qualifications which will spell success for him in his new venture.

War Time Built Vessels Still Operating Efficiently After Seven Years Service

THAT well constructed and well engined vessels were built in American yards during the feverish period of the World War, notwithstanding many opinions to the contrary, is shown by a recent survey of the steamships *Ipswich*, recently bought by the Argonaut Steamship Company, and the *Mystic*, now part of the Munson Line fleet, according to a recent statement of C. P. Stewart, president of Frank B. Hall and Company. Many ships built during the war period have been in continuous service for more than seven years and today are in first class operating condition.

The *Ipswich* was built by the Chester Shipbuilding Company to the order of the Shawmut Steamship Company, but the contract was requisitioned by the Shipping Board. The vessel was finally delivered to the Shawmut Company and later transferred to the American Ship and Commerce Company, being sold by them to the Ipswich Steamship Company of New York headed by Mr. Stewart.

In 1919 the *Ipswich* was first allocated to the C. H. Sprague and Sons Steamship Company and placed in the North Atlantic service between the United States and Rotterdam. She continued on this run until 1922, in which year she was placed in the intercoastal trade. During the first year of operation, this vessel traveled 40,000 miles and to date has logged more than 260,000 miles.

Mr. Stewart, in discussing the condition of the vessel, said that upon her recent arrival at New York, the *Ipswich* was carefully inspected and was found to be in excellent shape. The inspection revealed that this ship, built after the ending of the World War, is one of which American shipbuilders may justly be proud.

FUEL CONSUMPTION

The total fuel consumption during the last voyage was 12,142 barrels of oil which included oil used at sea and in port. It should, however, be noted that the port consumption includes that used for 707 miles of river and harbor steaming. (See Log of Voyage No. 20). The *Ipswich* is now engaged in the intercoastal trade carrying lumber from the vicinity of Portland, Oregon, to the Atlantic seaboard.

This vessel is a steamer of the so-called "three island" type and is propelled by geared turbines. The machinery was built by the Westinghouse Electric and Manufacturing Company, and consists of cross compound turbines and double reduction gears.

The turbines drive the first reduction gears, which in turn together drive the second reduction gear and propeller shaft. The whole gear train is arranged in a single housing. The high and low pressure turbine elements are each fitted with both ahead and astern blading. The blading in the first two rows of the high pressure turbine is of the impulse type while the remaining ahead blades in this unit, together with all the ahead blades in the low pressure turbine, are of the reaction type. Two rows of impulse blades in the high pressure and two rows of the same type of blades in the low pressure turbine are used for operating the ship astern.

A Kingsbury marine type propeller thrust bearing is located at the forward end of the second reduction gear.

PIPING ARRANGEMENT

The arrangement of piping for the high and low pressure turbines is such that, in an emergency, either unit could be cut out of service and the other operated independently. Under such circumstances the vessel will always be able to proceed at a reduced speed and at the same time have available necessary backing power. The overspeed governor, installed on the turbine, prevents the main units from exceeding the maximum safe speed for which they were designed.

The turbine nozzles, arranged for group control, effect considerable saving in steam consumption when operating at reduced speeds. The turbine glands, which are water sealed, absolutely prevent any steam leakage into the engine room. These two items are conducive to the high economy obtained aboard this type of vessel.

All turbine and gear bearings, together with the gear teeth are lubricated through a gravity system fed with a continuous oil supply. Two independent oil lubricating pumps discharge through coolers into an overhead tank from which the oil flows by gravity into the system.

The gears are of the flexible pinion frame design which was invented in 1907 by Admiral Melville and Mr. Macalpine. The Westinghouse Company, to date, has installed in this country over 1,200,000 horsepower of this type of drive. All of their marine gears are of this design.

Although the turbine operates at a speed of 3,480 revolutions per minute, the propeller has a speed of 80 revolutions per minute. The second reduction pinion runs at 517 revolutions per minute. The first reduction gear elements have a tooth pressure of 439 pounds per inch of face surface, while the second reduction gear operates with a tooth pressure of 848 pounds per inch. The propelling equipment is rated at a maximum of 2,900 shaft horsepower.

The condensing equipment installed on the *Ipswich* and *Mystic*, these two vessels having similar propulsion and condensing equipment, has proved the economy of ejectors for air removal in connection with turbine auxiliary machinery, according to Mr. Stewart.

Steam to the turbines is supplied by three Babcock and Wilcox watertube boilers each having 2,900 square feet of heating surface and fitted for oil fuel. Each boiler has installed a superheater of 290 square feet heating surface.

S. S. IPSWICH: VOYAGE No. 20

Duration: 107½ days. 52 days, 8 hours, 36 minutes at sea. 55 days, 3 hours, 24 minutes at port.
Round trip coastwise to Frisco, etc.
Dates: November 30, 1926, to March 17, 1927.
Observed miles, 12,680.
Barrels of fuel in port, 3,693 (harbor and river steaming 707 miles included in port consumption.)
Barrels of fuel at sea, 8,449.
Barrels of fuel total for voyage, 12,142.
Observed speed, 10.09 knots.
Wheel knots, 10.7.
Average revolutions per minute, 77.55.
Fuel 24 hours at sea, 161.04 barrels.
In port, barrels per day, 66.9 including river steaming.
Sea miles observation, 12,680.
Sea miles by screw, 13,447.
Pounds of fuel per observed mile, 223.
Weather rough, percent, 20 (taken as twice the normal slip of propeller).
Average draft, 23 feet.

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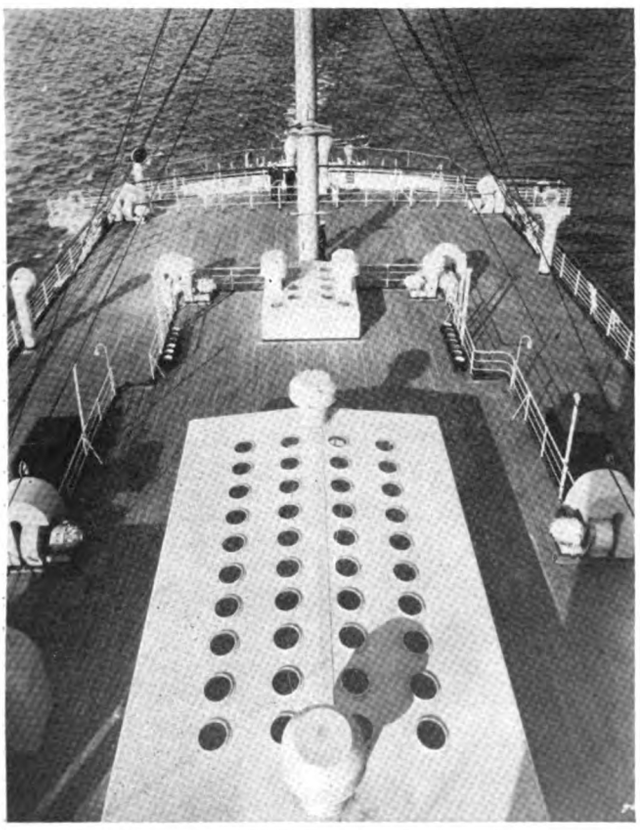
There are three tiers of steel deck houses above the promenade deck besides an officers' house, also of steel, above. All house tops are complete steel decks having calked teak sheathing outside of the houses. Inside of the houses and in the living quarters in the main hull woodoleum is laid.

The rudder is of the balanced type. It is broad at the top to conform to the shape of the hull in the vicinity of the stock opening and tapers to the usual thickness at its after end. Its area is 281 square feet and it is turned by a rudder stock of cast steel 23 inches outside diameter, having a 7½-inch axial hole. The rudder consists of a cast steel frame having a plate on each side to present a smooth surface. Wood filling with preservatives fills the spaces between the frame arms. The total weight of the rudder and stock is about 40 tons.

The propeller shafts are encased in bossing of unusually large size which permits access to the shafts and structure with a facility seldom obtainable. The spectacle frame castings for the two sides of the vessel are held together at the center line of the vessel by body bound bolts. The two spectacle frame castings weigh 157,900 pounds.

Resistance to transverse distortion of the hull is obtained by the 12 main watertight transverse bulkheads which extend to the shelter deck and by an extensive system of web frames and partial bulkheads which extends into the deck houses.

Bitumastic compositions have been extensively used to protect the structural steel work, being applied in the interior of the double bottom, bilges, peaks, chain lockers, tank tops and refrigerator spaces. The interior of the fresh water tanks is coated with a special composition known as "Waterite." All of this bitumastic covering, having a total surface of approximately five acres, was supplied and applied by the Briggs Bitumen Company.



Looking down on after terraced promenade decks

Looking aft on bridge deck, starboard side

The steel decks in staterooms, passages, public rooms and all similar spaces are faired up and covered with Terrano composition decking upon which the top tiling and carpets are laid. In the crew's quarters the floor is formed of finished Terrano without other covering. In all about 90,000 square feet of composition deck covering is laid on the ship.

While the watertight subdivision of the ship places her in a class by herself, so far as American vessels are concerned, and in large part is secured by complete bulkheads, unpierced by doors or other similar openings, facility of operation makes necessary certain access doors in certain bulkheads, principally in the machinery spaces. Wherever such access or communication has been found necessary, hydraulically operated sliding doors, 15 in all, of the Stone type, have been installed. These doors can be controlled both locally and from the navigating bridge where a Cory watertight door control annunciator has been installed by Chas. Cory and Son, Inc., New York.

PASSENGER ACCOMMODATIONS

The passenger accommodations are unusually complete. There are 43 staterooms with one bed, 57 with two beds, 26 with one bed and one Pullman berth, 146 with two beds and one Pullman berth, and 8 de luxe rooms with two beds. In addition, there are 27 sofa berths, which make a total passenger accommodation of 690, in 280 staterooms; 145 of these staterooms have private bathrooms. On two of the decks, every stateroom is connected with a private bath or toilet.

The dining saloon extends the full width of the vessel. It is 132 feet 6 inches long and has a seating capacity at small tables of 496 persons.

The galley and pantries and similar spaces are of ex-

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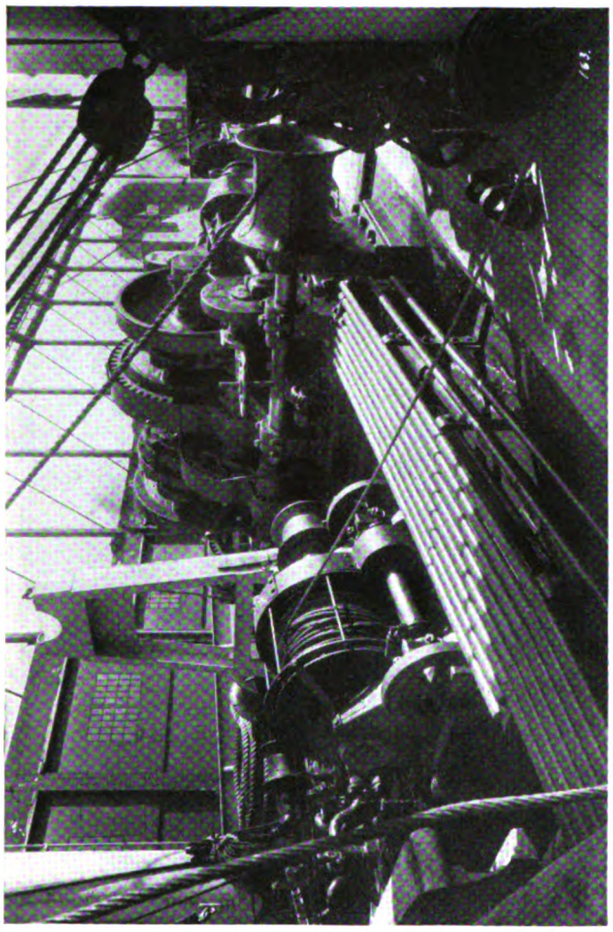
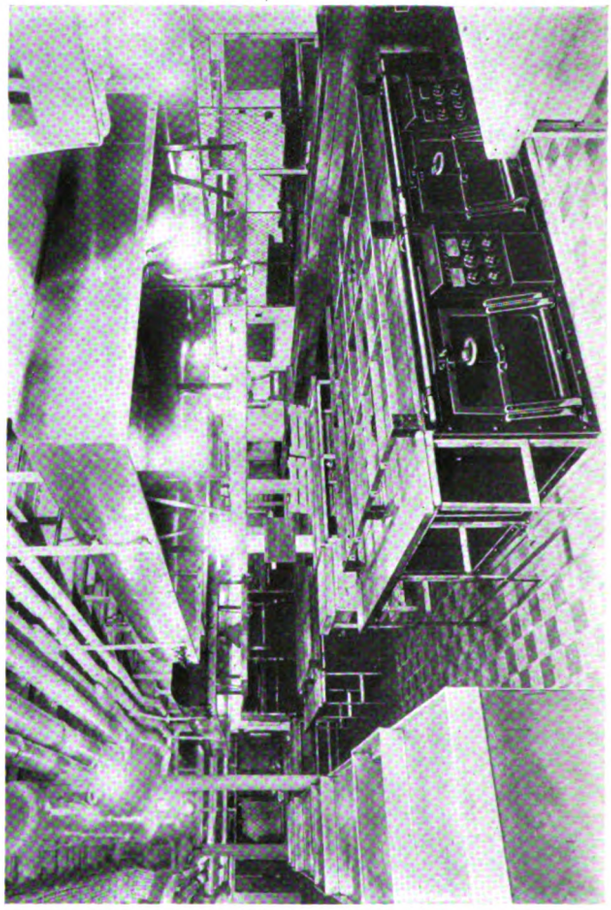
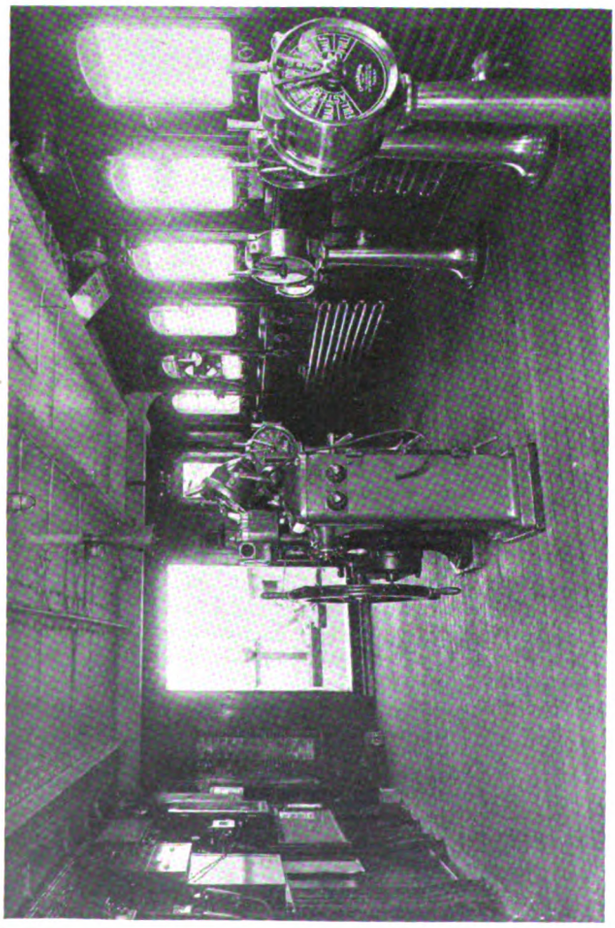


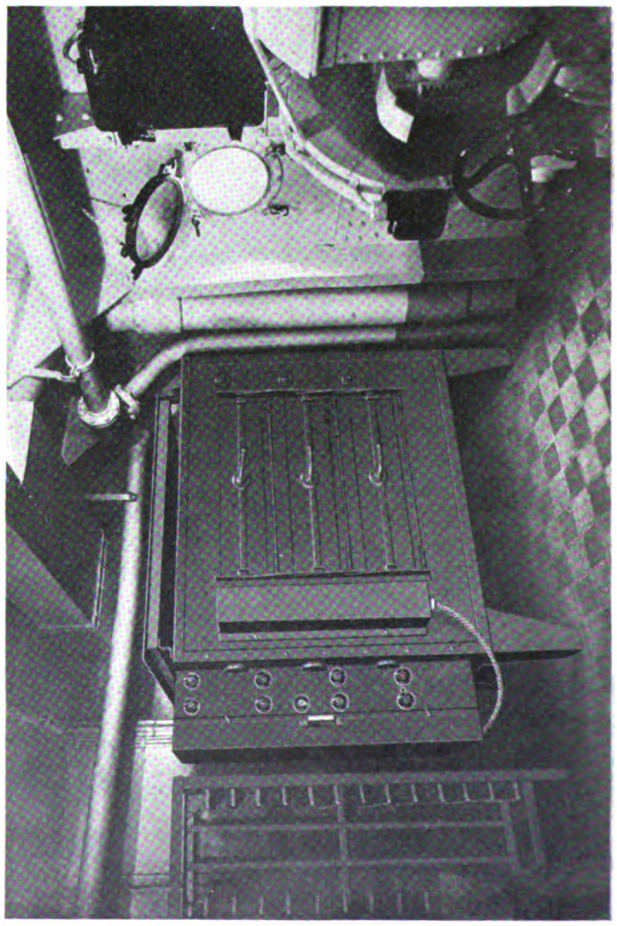
Anchor windlass and cargo winch



Main galley, showing eight Edison electric ranges and two broilers



Navigating bridge



Edison 180-loaf electric oven in bakery

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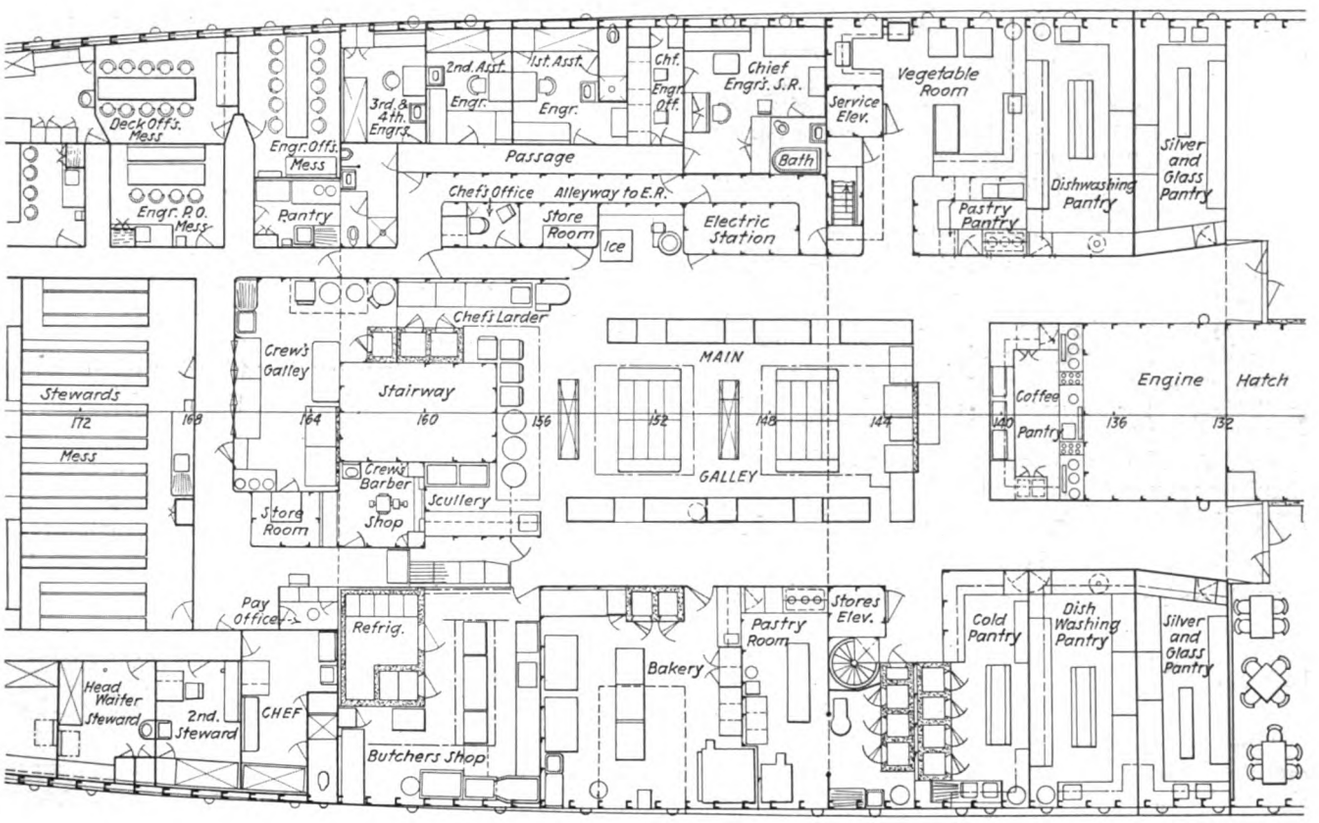
ceptional completeness and occupy a space about 90 feet long immediately aft of the main dining saloon.

GALLEY AND PANTRIES

One of the most interesting and important features of the *Malolo* is her electric galley. Aside from the *Republic* of the United States Lines, she is the only vessel afloat having a completely electrified cooking installation in galley and pantries.

As will be seen from the plan printed below the arrangement of galleys and pantries is very compact



Plan of the main galley and pantries

although, in general, not unlike that of other large liners. Such differences as are apparent are the result of electrification. The ranges, broilers and coffee pantry are in the center with serving tables each side of the former. Dish washing pantries are located on each side of the ship, together with bakery, pastry room, vegetable room, cold pantries and butcher shop. Storerooms and the ship's refrigerator are below, being reached by stairways and a stores elevator.

Interest in the galley equipment centers, of course, on the electrical apparatus which has been furnished by the Edison Electric Appliance Company. There are eight heavy duty ranges which are placed, back to back in two banks of four each. Forward of these are two electric broilers and a charcoal broiler. The ranges are rated at 22 kilowatts each and the broilers at 10 kilowatts each. The heating of the ranges and broilers is accomplished by "Calroad" heating units. These consist of nichrome resistance wire in the form of a helical coil centered in a steel tube and surrounded by finely divided, densely packed refractory insulation capable of withstanding high temperature and at the same time excluding air from the resistors. These units are cast into the hot plates of the range tops and for the ovens and broilers are formed into the shapes required and placed in unit frames. The refractory insulation is an excellent conductor of heat and so thoroughly protects the heating coils that they are practically indestructible. The ranges have a capacity 30 percent greater than that of a flame type range of equivalent size and the complete range and broiler equipment, having a capacity to cook for 1,200 persons, occupies only 100 square feet of deck space.

In the bakery there are two, three-deck electric ovens; one of 25 kilowatts for bread and one of 9 kilowatts for pastry.

In addition to the main equipment already described there are electric griddles, urns and hot plates for the main pantry and stewards' pantry service. Other galley and pantry equipment includes two "Victor" silver and glass washing machines and two "Victor" dishwashing machines, manufactured by the Victor Special Machine Company, Trenton, N. J., 22 sinks, 2 large steam tables, two ice cream cabinets, 8 coffee urns, bread mixer, steam kettles, slicing machine and other similar items, far too numerous to mention. The steam jacketed kettles are of the "Wear-Ever" type manufactured by the Aluminum Cooking Utensil Company, New Kensington, Pa., who also supplied portable utensils for the galley.

The total connected load of all the electric galley equipment is 220 kilowatts or approximately 35 percent of the total electric demand. It will operate mainly at "off peak" periods as most of the baking is done after midnight and in the early morning and the heavy cooking from early morning to late afternoon. When the lighting load comes on in the evening, practically all of the cooking is out of the way.

The galley has its own separate switchboard with a metering system and individual cut outs for each unit of equipment.

The owners of the *Malolo* intend that she shall be noted for superior meal service and the passengers will be assured that their food has been prepared in the most modern

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and sanitary culinary department ever installed on shipboard.

PUBLIC ROOMS

The sun deck is given over entirely to public rooms such as library, writing room, lounges, smoking room, and veranda. The total length of these enclosed spaces is 318 feet. Following an almost universal practice in modern first class passenger ships, a considerable portion of the *Malolo's* promenade deck (222 feet on each side of the vessel) is provided with counterbalanced sliding windows of heavy plate glass for use in wet and stormy weather. Similar windows are fitted in the bridge screens, all of the Beclawat type as supplied by the Kearfott Engineering Company, New York. The same company has also furnished the brass framed rectangular sliding windows for the deck houses, staterooms and other parts of the vessel. In all, over 360 Beclawat windows of the two types mentioned are installed on the ship.

Two elevators extend through the passenger spaces.

RECREATION FEATURES

On the uppermost deck there is a children's game space surrounded by netting about 9 feet high. Two places are available for the showing of motion pictures, one inside and one out. A swimming pool, 30 feet by 20 feet, together with a well equipped gymnasium and electric baths, is available for the passengers' enjoyment. The swimming pool sides and bottom are of flush steel finished in white enamel. The spaces around it are fully tiled. There is a circulating pump for the pool and also a heater near this pump and connected with the supply to the pool.

HOSPITALS

The passenger hospital consists of two wards, a bath, dispensary and operating room; all very completely fitted out. There is also a crew's hospital of one ward and a bath room.

LAUNDRY AND BARBER SHOP

A modern, electrically equipped laundry of sufficient capacity to meet all the general laundry requirements of the ship and also to handle the personal laundry of passengers, officers and crew is installed and also a tailor shop to take care of repairs, cleaning and pressing.

Forward, on F deck is a three-chair barber shop and on the opposite side of the same deck a ladies' hairdressing room with two chairs.

The equipment, both deck and navigation and for the steward's department and the passenger and crew accommodation is unusually complete and of the very best quality obtainable in every department.

Turning first to the deck and navigation outfits, the boats which were manufactured by the American Brown Boveri Electric Corporation of Camden, N. J., comprise 2 motor lifeboats, 12 non-nesting and 4 nesting open lifeboats and 2 working boats.

LIFEBOATS

The motor lifeboats, which are of a special design, are built of galvanized steel and are 31 feet long, 10 feet beam and 4 feet 6 inches molded depth. They are decked and have two transverse watertight bulkheads, steering and engine controls being arranged in a self-bailing cockpit aft of the engine space. The propelling unit is a 16-18 "Standard" reversible heavy duty gasoline motor. These boats are equipped with a radio outfit, the antennae being carried on two hinged masts at a height of 28 feet above the water.

The nesting and non-nesting boats are also built of steel and are of the usual round bilged type. They are 28 feet long, 9 feet 4 inches beam and 4 feet deep.

The two working boats, which are certified as lifeboats, are 20 feet long, 6 feet 6 inches beam and 3 feet deep.

All boats are stowed under Steward mechanical davits and are hoisted by three Lidgerwood-Diehl electric boat winches.

GROUND TACKLE

The ground tackle consists of 5 Baldt stockless anchors, two of 14,805 pounds each, one of 12,600 pounds and one 5,460 pounds. The chain cables are of cast steel, made by the National Malleable and Steel Castings Company. They are of 3⅛-inch wire diameter and have a total length of 330 fathoms.

Two steel towing hawsers, one 2⅛ and the other 1 15/16 inches in diameter, and each 150 fathoms in length have been furnished by the American Cable Company.

Hazard wire rope was used for the rigging, the rigging work being done by Arthur N. Taylor of Philadelphia.

NAVIGATING EQUIPMENT

The navigating equipment includes a Sperry alternating current gyro-compass supplied by the Sperry Gyroscope Company, Brooklyn, N. Y., which in addition to the master gyro-compass includes the following equipment:

One steering repeater, mounted on top of the gyro-pilot in the wheel house.

Two bearing repeaters, one in each wing of the bridge. These repeater stands are provided with yokes for supporting range finders, making a combination instrument by which accurate geographic bearings can be taken on the repeater compass and the distance of the object, on which the bearing is taken, determined at the same time. This is one of the first merchant vessels in this country to be equipped with this range finder attachment.

One course recorder for making a graphic record of the ship's course and time, and

A two unit type gyro-pilot, which affords manual steering electrically as well as automatic steering. The gyro-pilot is installed in such a way that transfer from the gyro-pilot to the hydraulic system or from the hydraulic system to the gyro-pilot may be accomplished by means of a lever on the side of the gyro-pilot housing, thus eliminating the necessity of sending a man to engage or disengage couplings.

The *Malolo* carries an 18-inch high intensity Sperry searchlight, giving a beam candle power of 30,000,000. There is also installed a standard Sperry helm angle indicator of the self-synchronous motor type and a Sperry engine speed indicator for each shaft mounted in the wheel house. Between the two indicators there is mounted a comparator, showing the relative speeds of the shafts.

The bridge equipment includes four "Clearview" screens for use in bad weather which have been furnished by Chas. Cory and Son, Inc., New York. Two of these screens are of the window type and two of the hood type fitted to pedestals at the ends of the bridge with pelorus for taking bearings.

A navigation range finder, on a pelorus mounting is installed.

CABIN EQUIPMENT

The outfit of bedding, linen, blankets and similar cabin equipment is exceptionally complete, some idea of its extent being given by the fact that nearly 150,000 square yards of linen and cotton cloth were used. A particularly fine quality of woolen blankets, identical with those on the *Leviathan*, has been supplied to the ship by the North Star Woolen Mill Company, Minneapolis, Minn.

Exclusive of rugs and runners, approximately one acre of carpet is laid in staterooms and other quarters and spaces and in addition about 35,000 square feet of cork or rubber tile, 10,000 square feet of ceramic tile, 5,700

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square feet of galley tile and 2,000 square feet of mosaic tile.

The silver ware equipment consists of over 27,000 pieces, the largest ever ordered for an American vessel. The entire equipment of glass ware, comprising 40,000 pieces, was supplied by the United States Glass Company, Pittsburgh, Pa. The deck chairs were supplied by the Readsboro Chair Company, Readsboro, Vt.

HEATING AND VENTILATION

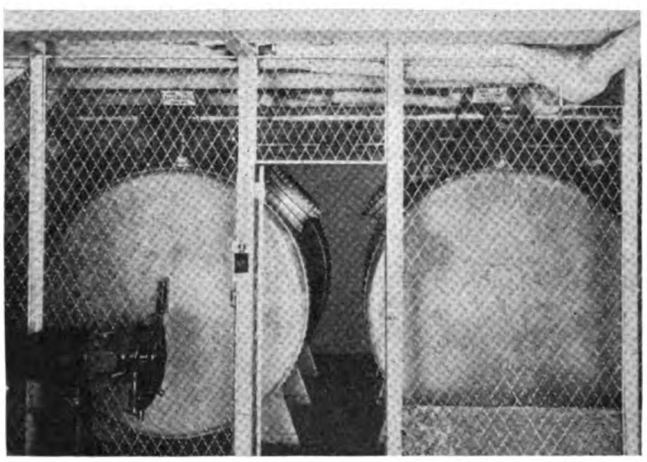
An unusually complete system of steam heating and mechanical ventilation is installed. The passenger rooms in general are provided with forced ventilation and local steam radiators. Air will be supplied to the public rooms and passenger spaces at the rate of a complete change every 6 minutes; to the dining saloon every 5 minutes; hospital spaces, swimming pool and galleys every 4 minutes. In addition the exhaust from the hospital spaces and swimming pool is 25 percent in excess of the supply and from the galleys and pantries 30 percent in excess of the supply.

PLUMBING

It is claimed that the *Malolo* has a greater number of private baths than any other vessel now afloat, there being 160 in all, and in addition numerous public baths and toilets. The plumbing contract, which was placed with the A. B. Sands and Sons Company of New York, also included over 200 toilets, 400 lavatories, and numerous showers, sprays and other fittings and in total is the largest order for marine fittings of this kind which has ever been placed in the history of American shipbuilding.

FIRE PREVENTION

Every precaution has been taken to prevent the occurrence of fires and to localize and subdue them if they do occur. Fire screen bulkheads of wood, covered with asbestos and galvanized iron divide the passenger quarters into small compartments and hydrants and hose connections



Foamite solution tanks

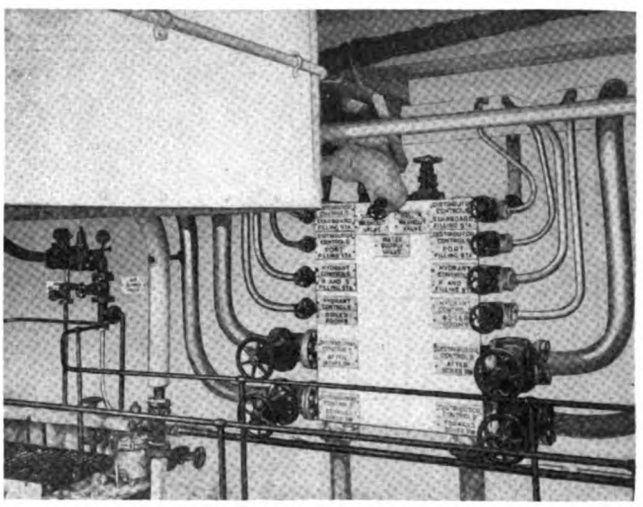
are arranged to easily reach every corner of the vessel. In addition a complete Cory-Aero automatic fire detecting and alarm system, furnished by Chas. Cory and Son, Inc., New York, has been installed in all passengers' and crew's quarters and public rooms and special provisions have been taken to detect and combat fires in cargo holds and store room and in the machinery spaces.

In the boiler rooms and at the fuel oil filling stations, a Foamite fire extinguishing system, furnished by the Foamite-Childs Corporation, Utica, N. Y., has been installed consisting of two solution tanks, a mixing tank, steam charging pump, manifolds, valves and piping. In addition a number of portable Foamite fire extinguishers are carried.

A Rich smoke detection system, supplied by Walter Kidde and Company, New York, is installed in all cargo holds and in the mail room, paint room and similar spaces with the detecting cabinet in the wheel house. With this is combined a steam smothering system so that the same pipes are used for detecting and for extinguishing fires.

INTERIOR COMMUNICATION

The *Malolo* is equipped with a complete service telephone system consisting of approximately 323 telephones,



Foamite control valve manifold

one of which is installed in each passenger and crew stateroom. This service is handled through a regular telephone exchange on board the vessel which will be connected with the regular telephone system on shore whenever the vessel is in port, so that as soon as the vessel docks passengers will have regular long distance service to any point in the United States. The passenger telephone equipment was supplied by the Western Electric Company.

In addition to the passenger telephone system an anti-noise telephone system is installed for handling the ship, providing communication between the bridge, after-docking bridge, forecastle, crows nest, steering gear room and main engine room. A second loud speaking telephone system is also installed for communication between the chief engineer's stateroom and the main engine room. The two loud speaking telephone systems were installed by Charles Cory and Son, Inc., of New York.

A very complete electric clock system consisting of a master clock and 22 secondary clocks has been installed by the Magnetic Clock Company of New York.

HULL MACHINERY

The anchor windlass is of the Hyde type, spur geared and has two 14-inch by 14-inch steam cylinders. The wild cats are horizontal, designed for handling 3⅛-inch stud link chain and on the intermediate shaft are two quick warping gypsy heads 20 inches in diameter.

In addition to the windlass, the Hyde Windlass Company furnished two steam gypsies with 10-inch by 10-inch double reversible engines and six reversible cargo winches with double 8¼-inch by 10-inch cylinders.

To facilitate the handling of cargo, two athwartship belt conveyors are installed on F deck. At each end of the belt conveyors are slat conveyors extending upward at an angle

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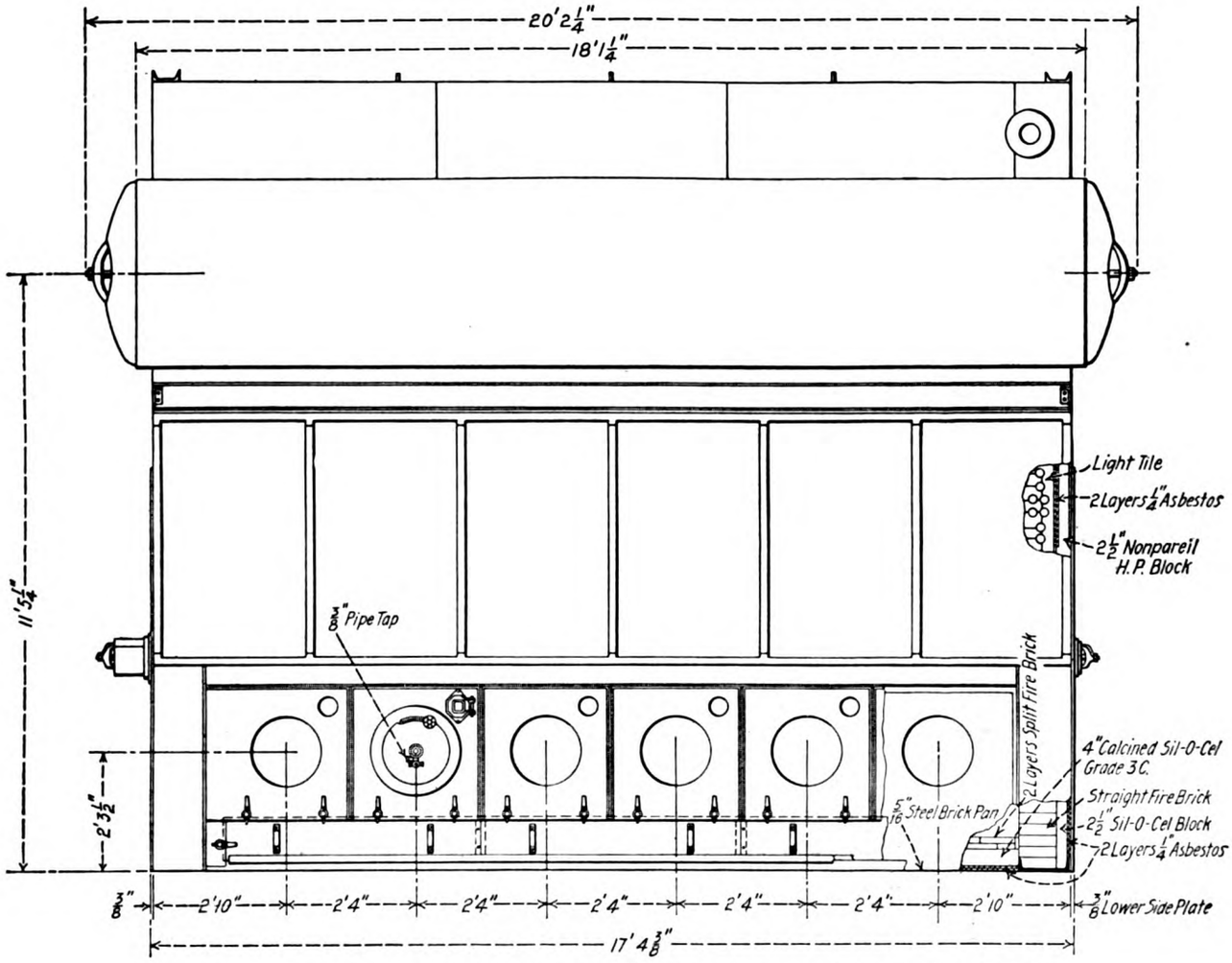

Front elevation of one of the Babcock and Wilcox boilers installed on the Malolo

of 30 degrees, through open hatchways to E deck there delivering to outboard conveyors rigged through the cargo ports and discharging onto the pier. When not in use these outboard conveyors are hoisted inboard and stowed on top of the inboard conveyors. This entire conveyor system was furnished by the Lamson Company of Syracuse, N. Y.

In addition to the handling machinery already mentioned a number of Shepard electric hoists are employed for various purposes. These include four 500-pound hoists for the linen hatches, two of 2,000 pounds each for the cargo conveyor compartments and three of 2,000 pounds each for the engine and boiler rooms.

The rudder of the *Malolo* has an area of 281 square feet and when hard over with the ship running at full speed has to withstand a water pressure of 125 tons. To handle this heavy load a right and left hand screw gear is connected to the rudder stock. The gear is actuated by two double cylinder horizontal steering engines one of which is fitted as a standby. The cylinders of these engines are 16 inches in diameter and 12 inches stroke and both hydraulic and electric telemotors are fitted for their control from the bridge. The steering gear, which weighs 40 tons was furnished by the Bethlehem Steel Company and the electric telemotor, which operates in conjunction with a gyro-pilot, by the Sperry Gyroscope Company, Brooklyn, N. Y.

Propelling Machinery

The propelling units are in two engine rooms, as shown in the hold plan on pages 608 and 609. Each propelling unit, except the cruising turbines, can be operated with the engine room containing the other unit flooded. Each unit consists of one high pressure turbine, one first intermediate pressure turbine, one second intermediate pressure turbine, one low pressure turbine, and one geared cruising turbine, all of the Parsons type. These turbines drive the shaft through two De Laval reduction gears in separate casings connected by a short length of shaft. The high pressure turbines are of the combined impulse and reaction type and through additional nozzles the high pressure impulse wheel can carry approximately 25 percent overload. A by-pass is provided over the first stage of the reaction blading. The two intermediate pressure turbines are of the single flow reaction type and the low pressure turbine is of the double

Steam steering gear

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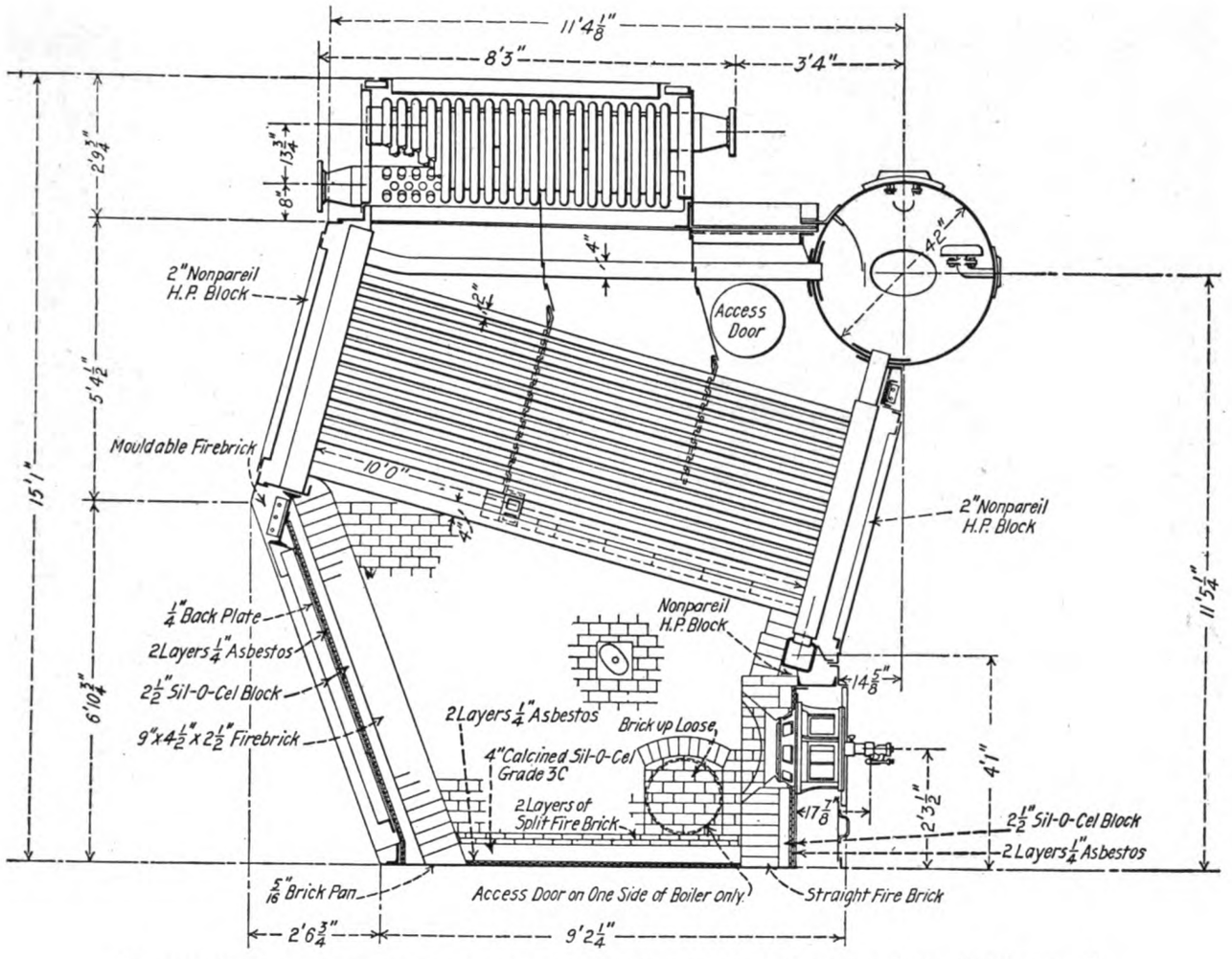

Cross section of boiler: steam pressure, 280 pounds per square inch; superheat, 100 degrees F.

flow reaction type. Astern elements of the impulse type, designed to develop 70 percent of the ahead power, are built in the second intermediate pressure and low pressure turbines and, for each shaft, operate in series. The high pressure nozzle boxes, cruising turbine casings and parts of the high pressure casings subject to working pressures of 100 pounds per square inch are of cast steel; the other casings are of cast iron.

Under cruising conditions when half power is being used, giving a speed of approximately 16½ knots, the cruising units which are connected to an extension of the high pressure rotor shaft by jaw clutches take steam before it passes through the other four units. Emergency operation of the machinery is provided for by using boiler steam through the cruising units in series with the high pressure and first intermediate pressure turbines, the latter exhausting direct into the condenser, or by using boiler steam through the second intermediate pressure and the low pressure turbines.

When developing 12,500 shaft horsepower on each shaft, the revolutions per minute of the propellers will be about 121, at which speed the revolutions per minute of the gears will be approximately 1,450—a reduction gear ratio of about 12 to 1. The gears are so designed that the load per lineal inch of tooth is about 410 pounds at 25,000 shaft horsepower. All parts of the gears and turbines are designed to have working stresses of about one-fifth of the elastic limit. The gearing is of the double helical type, the gear faces being in halves with right and left teeth. The pinions have a middle bearing as well as two end bearings. The pinions have a pitch diameter of about 11.7 inches and the gears 140 inches. The forged steel rims shrunk on the cast iron centres of the gears have a tensile strength of about 65,000 pounds and the nickel steel forgings from which the pinions are made have a tensile strength of about 90,000 pounds. The diameter of the gear shaft at the gear center is 25 inches and the weight of shaft and gear is 80,000 pounds.

The shafting, aft of the reduction gears, which consists of 2 propeller shafts, 10 sections of line shafts, 2 intermediate and two thrust shafts, was forged by the Bethlehem Steel Company, the total weight as delivered to the builders and including couplings, collars and a spare tailshaft being 26 tons. The main thrust bearings are of the Kingsbury type and bearings of the same type are fitted to each of the main turbine rotors.

The line shafting is in general 20 inches outside diameter with a 6¾-inch axial hole. Each section of shafting is supported by two bearings.

Two main condensers, each of about 16,000 square feet cooling surface, are provided. Scoop circulation of cooling water is provided. At low ship speeds each condenser is served by a turbine driven centrifugal circulating pump. With each main condenser there is a vacuum augmenter with augmenter condenser and a vertical twin beam single acting air pump.

BOILERS

The boiler equipment consists of 12 Babcock & Wilcox oil fired boilers, having a total heating surface of 55,764

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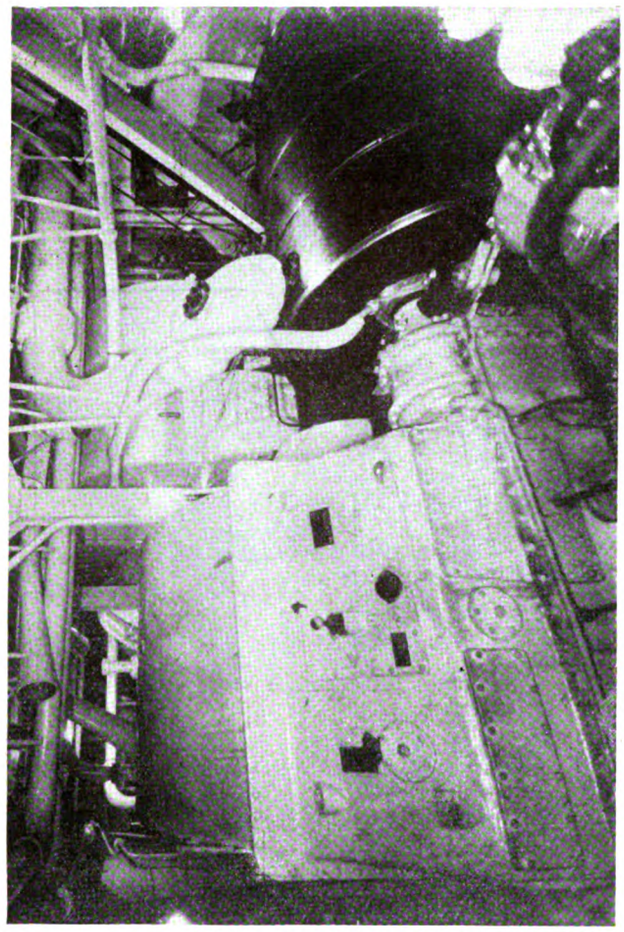
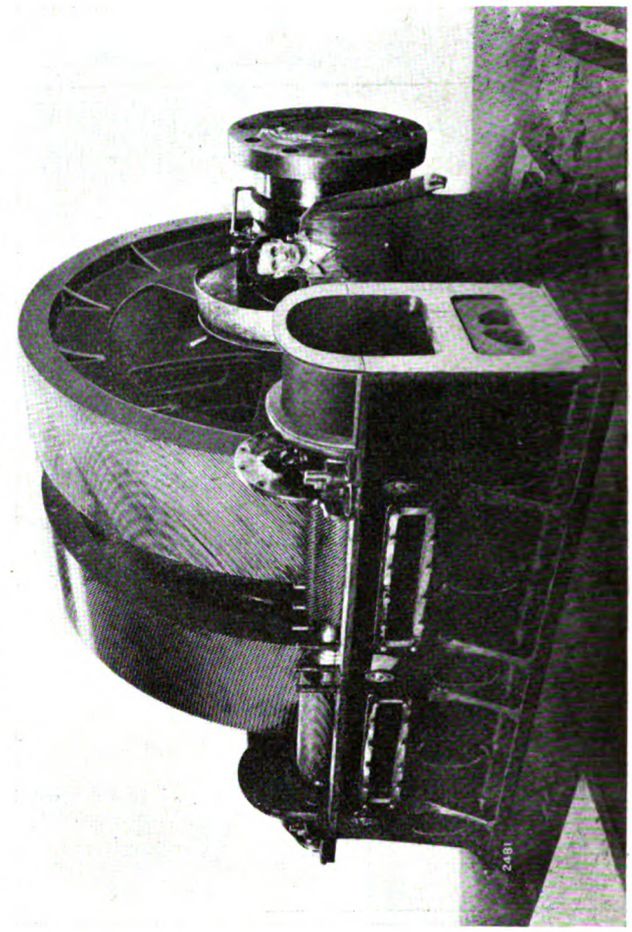
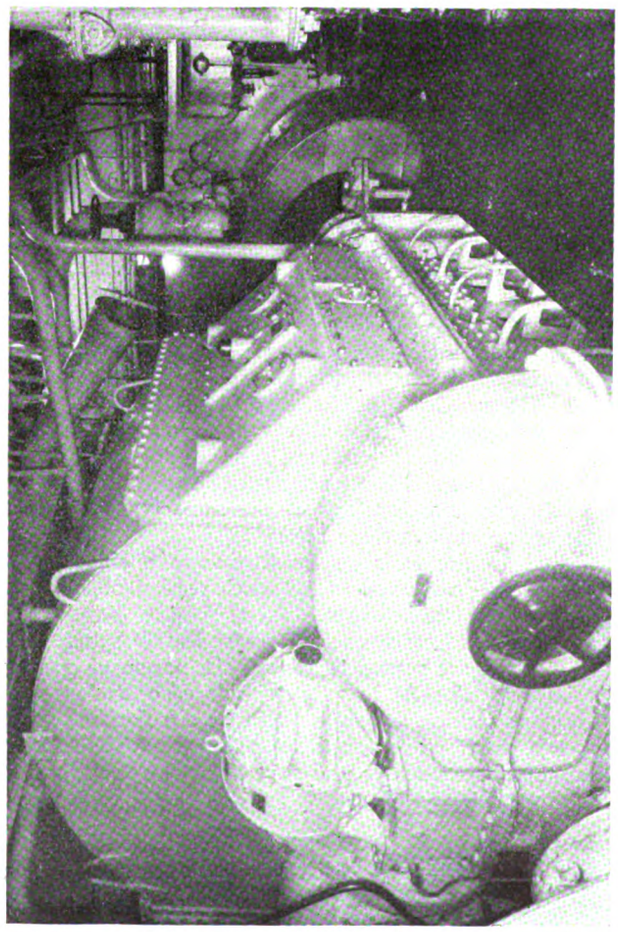


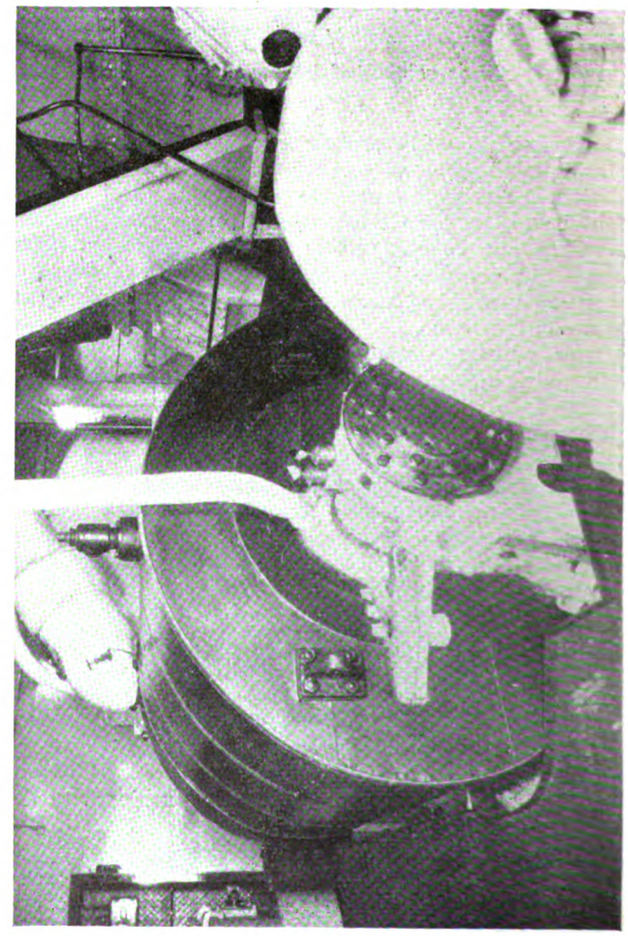
Second intermediate pressure turbine and reduction gear



De Laval turbine reduction gear with cover removed



First intermediate pressure turbine and reduction gear in forward engine room



Second intermediate and low pressure turbines in forward engine room

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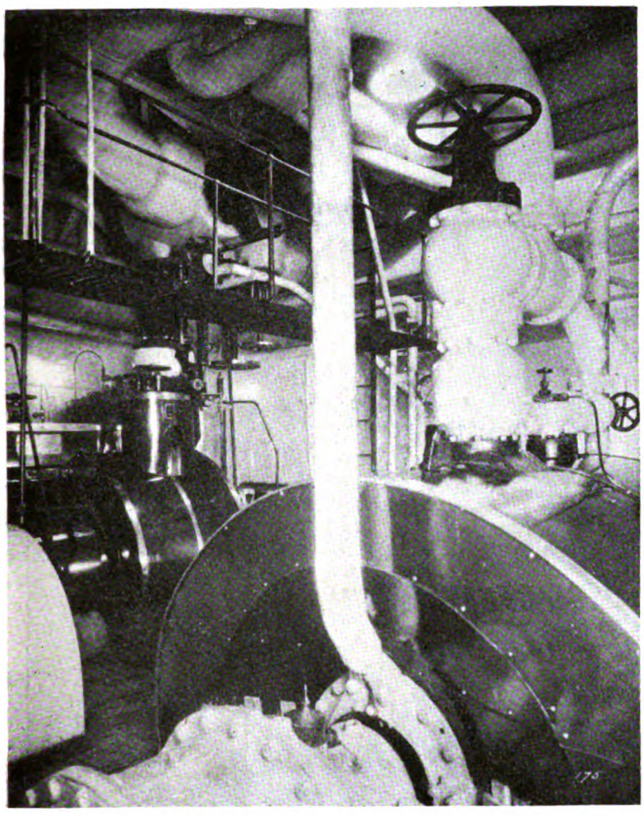
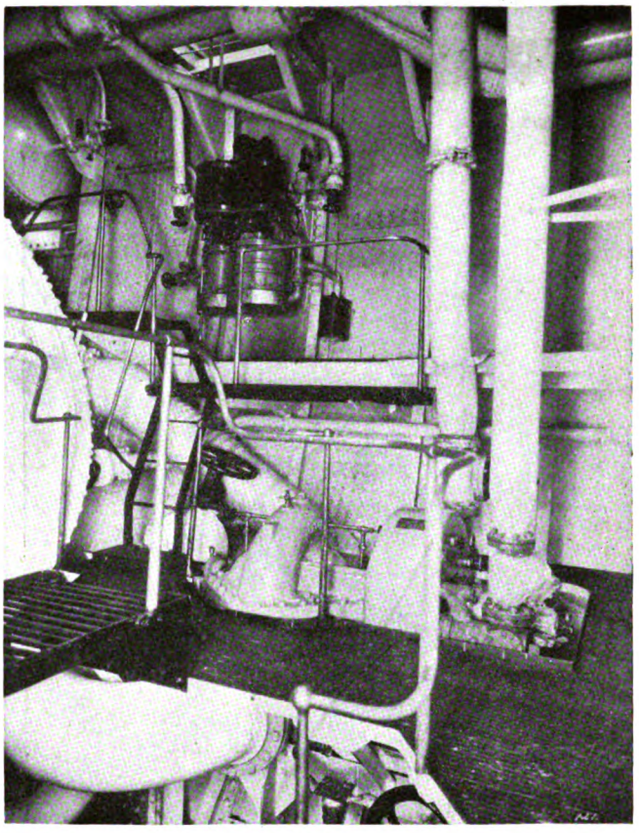
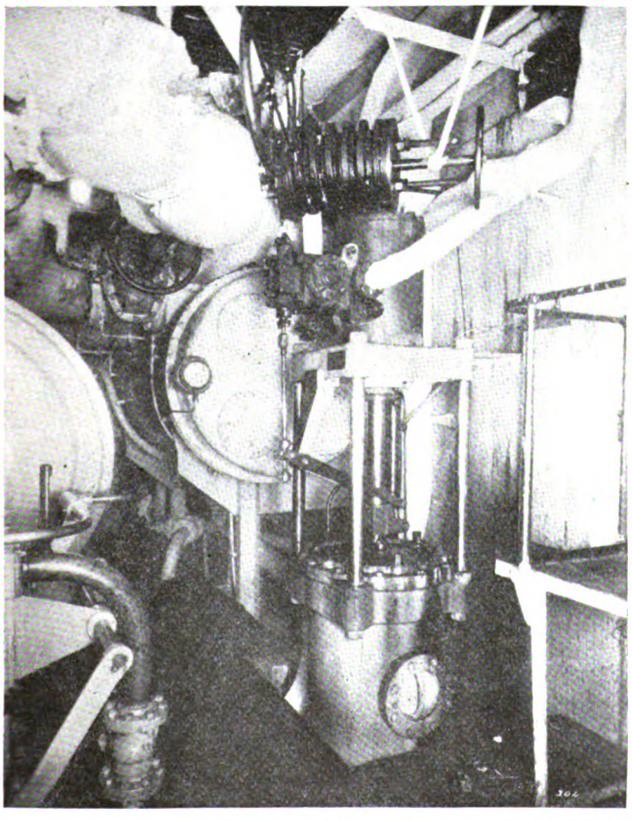


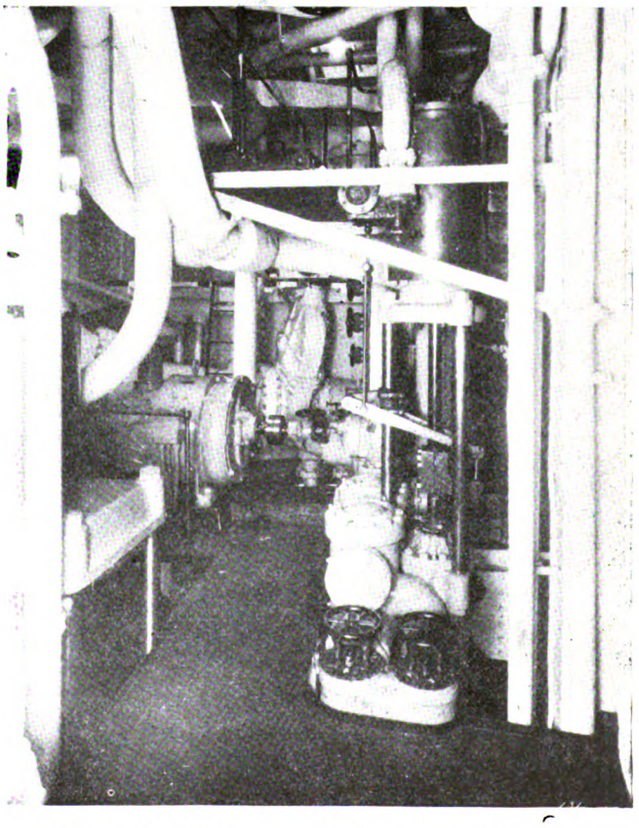
High pressure and first intermediate pressure turbines



Main circulating pump in after engine room



Auxiliary condenser and air pump in forward engine room



Fire and sanitary pumps in forward engine room

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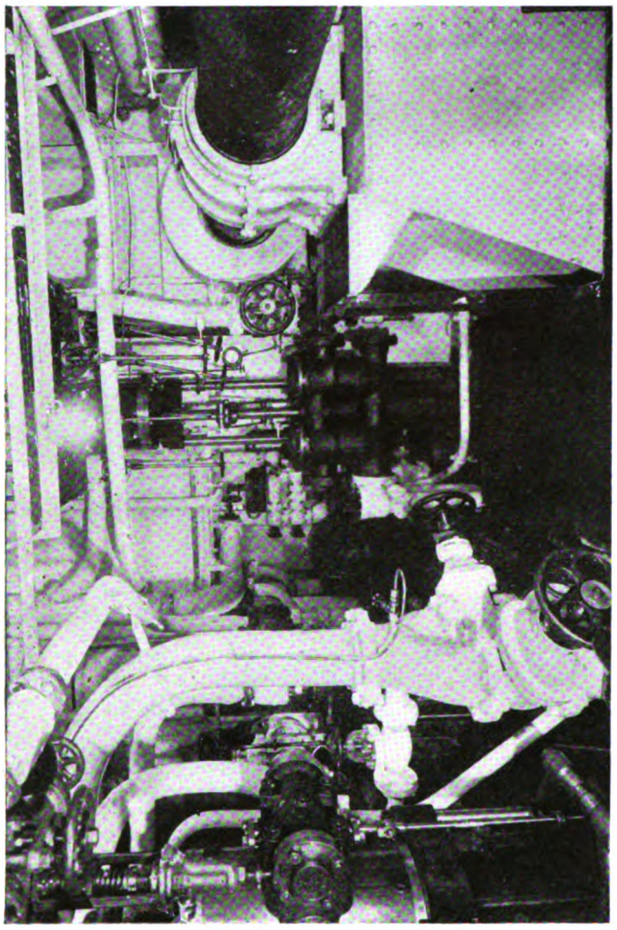
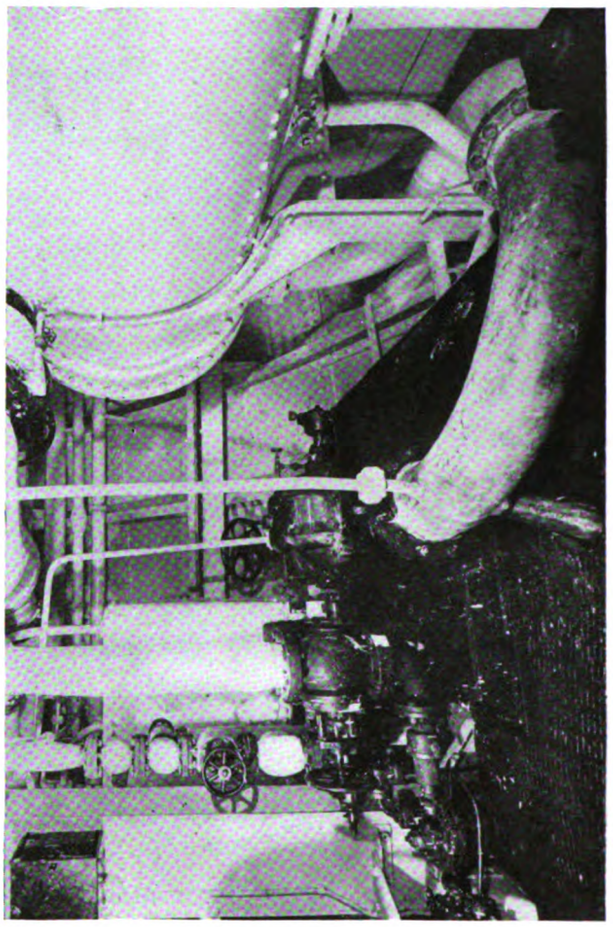
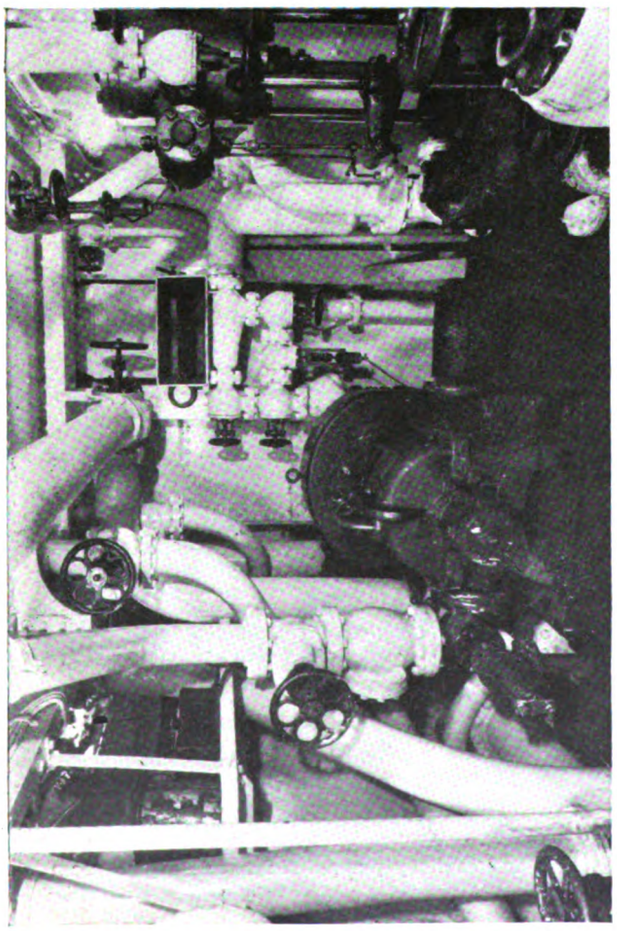


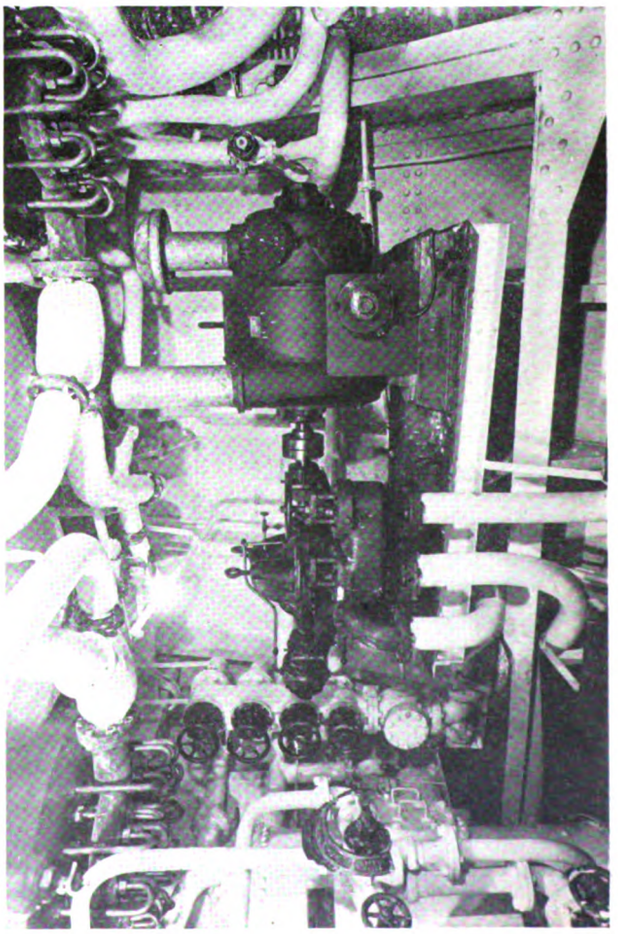
After auxiliary feed pump (lubricating oil pump at left)



Centrifugal auxiliary circulating pump



Centrifugal after main feed pump (wash water pump at right)



Fire and sanitary motor driven centrifugal pump

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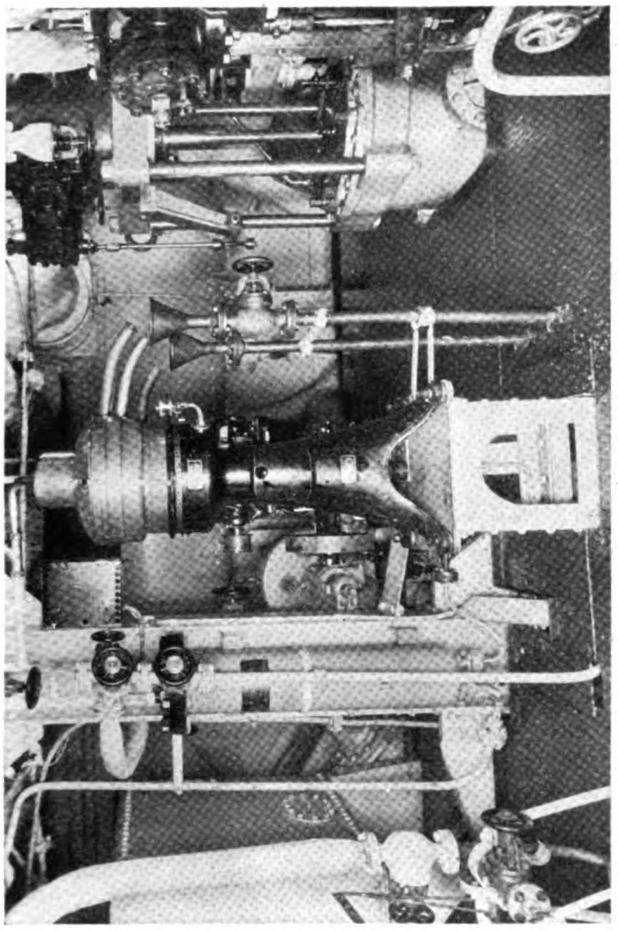
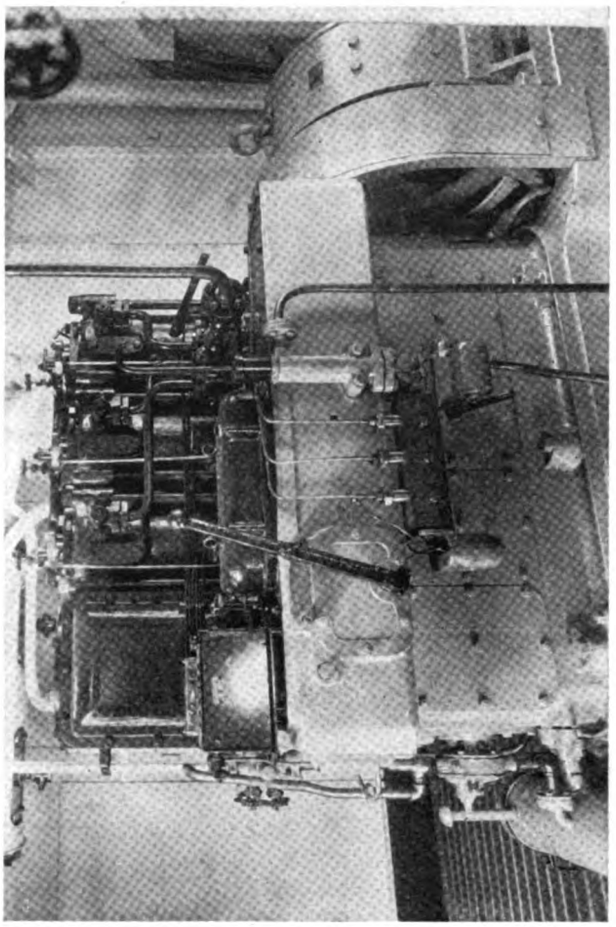
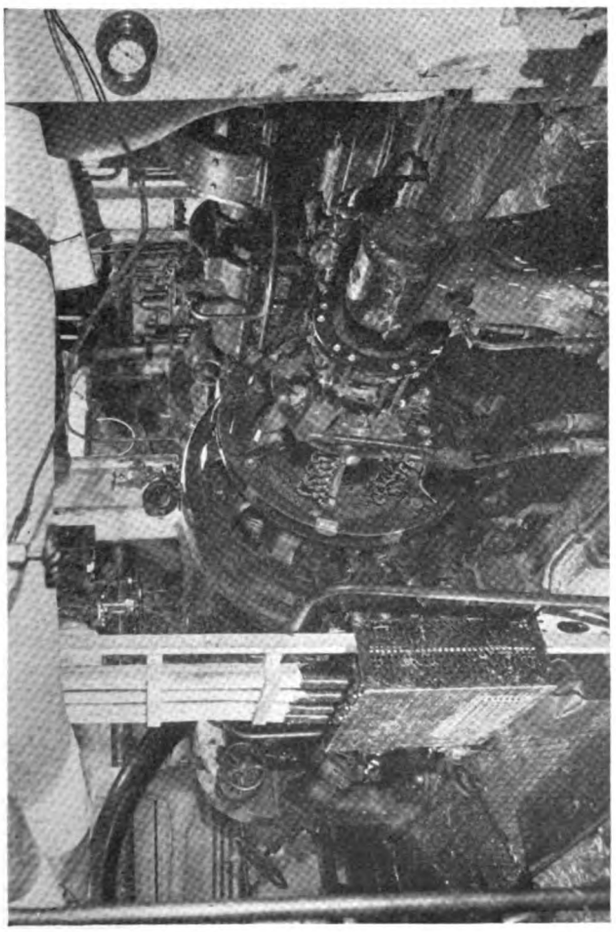


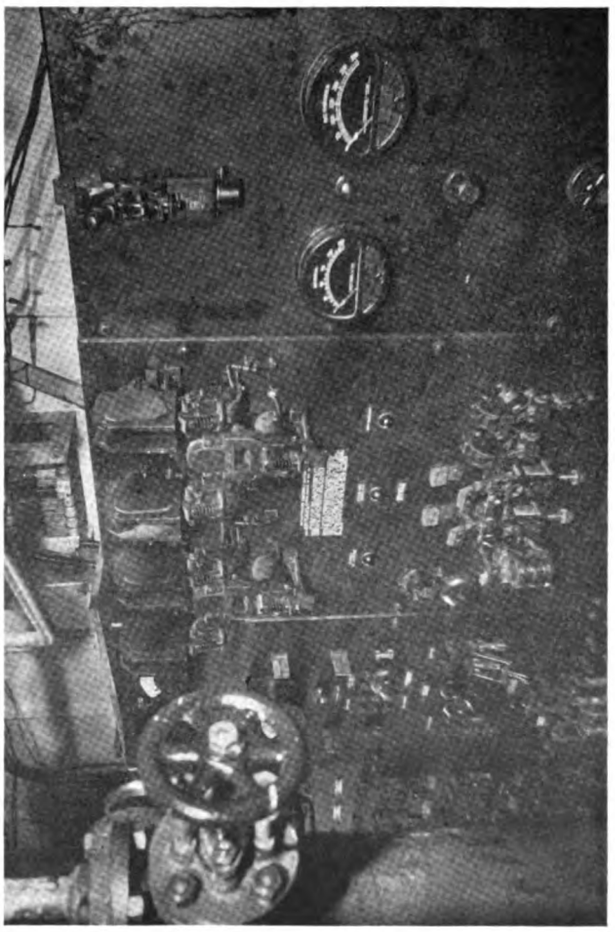
De Laval centrifugal lubricating oil purifier



Emergency Diesel generator set



One of the main turbine generator sets



Section of emergency switchboard

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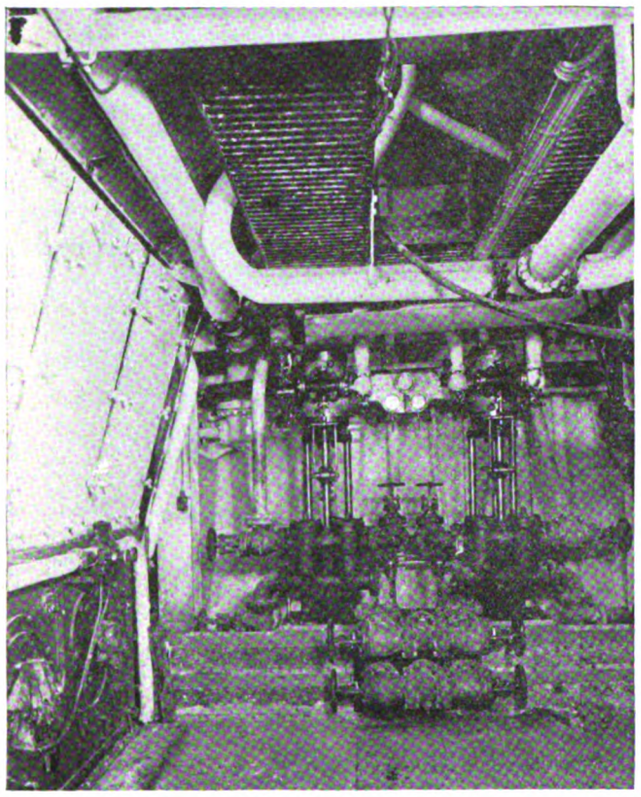
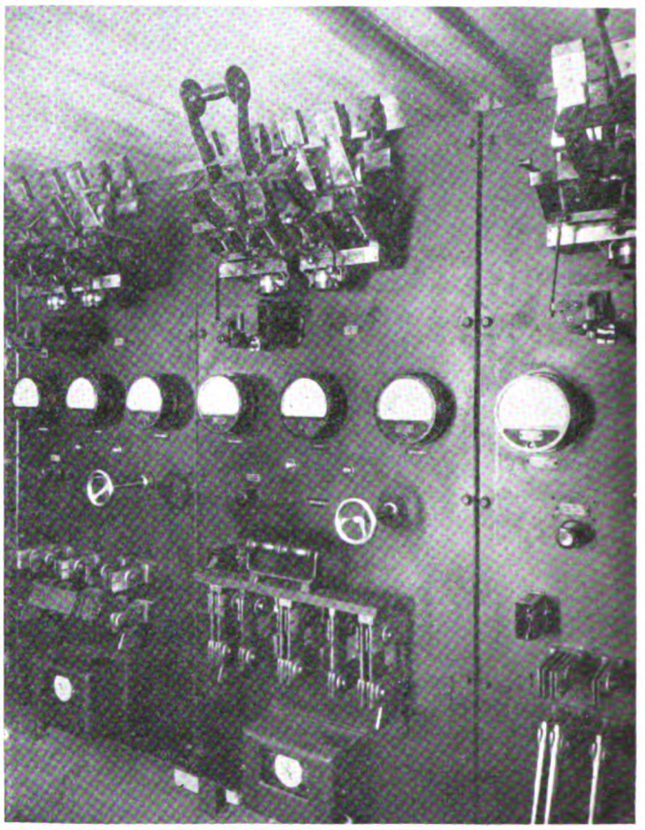
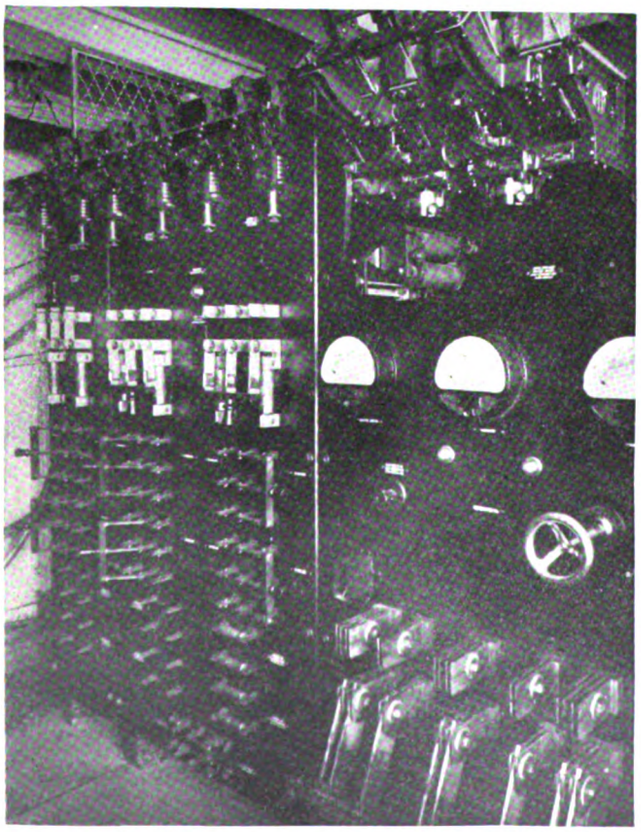


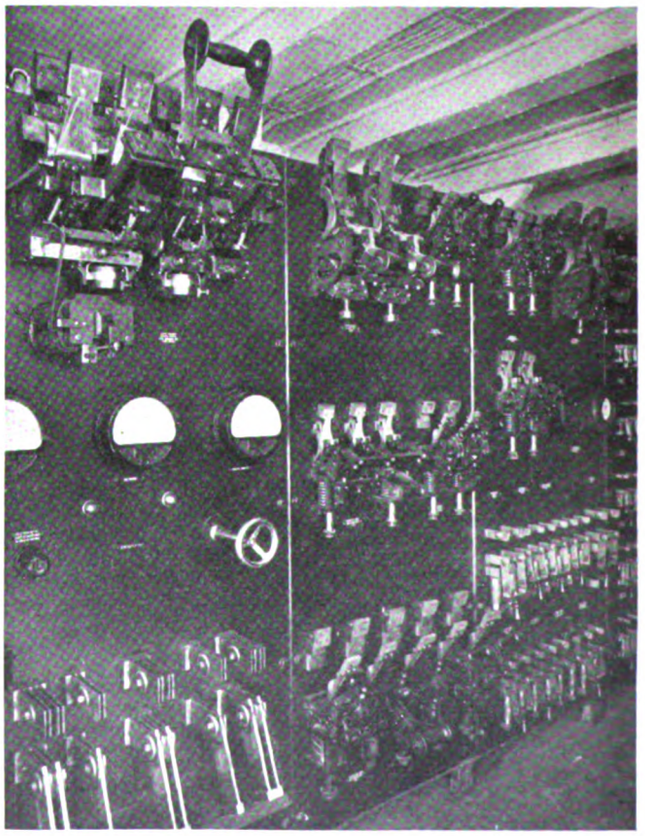
Auxiliary feed pump in forward boiler room



Generator panel of main switchboard



Lighting section of main switchboard



Auxiliary power panel of main switchboard

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square feet and a superheating surface of 11,160 square feet. The working pressure is 280 pounds per square inch and the superheat 100 degrees. Each boiler is equipped with 6 Babcock & Wilcox oil burners, all of which are arranged for operation under forced draft.

The 12 boilers are located in two fire rooms, 6 in each. The uptakes in each boiler room connect into a common breeching and the two latter into a single stack. This stack, which is double, has a total height of 120 feet above the base line and an elliptical outer casing 28 feet in fore and aft diameter and 17 feet athwartships. A dummy stack of the same outside dimensions is fitted over the two engine rooms.

Seven Diamond soot blower units, supplied by the Diamond Power Specialty Corporation, Detroit, Mich., are installed in each boiler, 5 in the boiler proper and 2 in the superheater.

Forced draft is supplied by 12 Sturtevant multivane motor-driven fans.

PROPELLING MACHINERY AUXILIARIES

The great size of the propelling plant, as well as its somewhat unusual arrangement, involves the use of a large amount of auxiliary machinery of various types.

The complete pumping equipment, both for serving the propelling machinery and for sanitary, bilge, ballast and fire fighting systems was furnished by the Worthington Pump and Machinery Corporation, New York.

More than ordinary pains were taken to specify pumps guaranteed to work at maximum efficiency under a variety of conditions. Emphasis was placed on dependability and to this end the materials were selected with extreme care, particularly those which went into the making of bearings and running gear. Centrifugal pumps driven by electric motors were chosen wherever feasible, principally because this type could derive power from the central generating plant and operate at a minimum expenditure of fuel. Where the use of steam effected a better regulation of the centrifugal pumps, however, and where the exhaust from the turbines could be used to advantage in heating feed water, Sturtevant steam turbines were selected. Reciprocating pumps are used in certain cases where the high working pressures used and the temperatures encountered made this type advisable.

With the main condensers, large main air pumps of the twin beam reciprocating type are used, both for reliability and the varying conditions of service under which this vessel will be operated. Steam turbine driven main condenser circulating pumps, of the most compact and up-to-date design, supplement the main air pumps. The auxiliary condensers, too, are similarly equipped with separate vacuum systems.

Steam turbine driven main feed pumps provide the boiler feed system of the ship. Long stroke reciprocating pumps are employed in the engine and fire rooms for cruising speeds and for port use.

Long stroke vertical simplex service pumps were furnished for the fuel oil system. To pump oil ashore through long lines, and to transfer oil to the daily supply tanks, the transfer pump does a double duty.

Ballast pumps, bilge pumps, fire and engine rooms, washing water pumps, fire pumps, evaporator feed pumps, drinking water pumps, boiler testing pumps and lubricating oil pumps are of the Worthington simplex long stroke type.

Steam turbine or electric motor driven centrifugal pumps serve the ice water recirculating system, the swimming pool recirculating system, the lubricating oil cooler, hot salt water and hot fresh water systems.

The complement of reciprocating steam driven pumps, also steam turbine driven and electric motor driven centrifugal pumps, is used for the services indicated below:

Air pumps for main condensers.
Circulating pumps for main condensers.
Air pumps for auxiliary condensers.
Circulating pumps for auxiliary condensers.
Feed pumps for engine room.
Auxiliary feed pumps for engine room.
Feed pumps for fire room.
Feed pumps for evaporators.
Pumps for drinking water.
Pumps for fuel oil transfer.
Pumps for fuel oil service.
Pumps for ballast.
Bilge pumps for engine room.
Bilge pumps for fire room.
Pumps for washing water.
Pumps for sanitary system.
Pumps for lubricating oil.
Pumps for boiler testing.
Pumps for fire service.
Pumps for ice water recirculating.
Pumps for swimming pool water recirculating.
Pumps for lubricating oil coolers.
Circulating pumps for lubricating oil coolers.
Recirculating pumps for hot salt water system.
Recirculating pumps for hot fresh water system.
Circulating pumps for dynamo condensers.

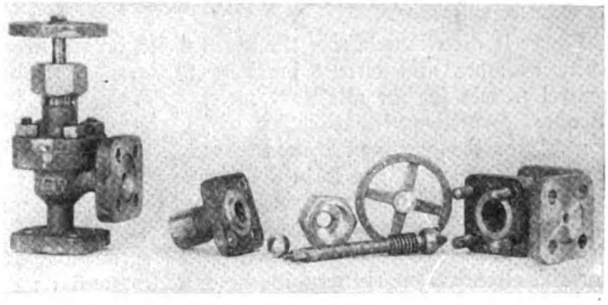
Ideal marine pump governors, manufactured by the Atlas Valve Company, Newark, N. J., are installed with many of the pumps.

A complete Worthington Diesel engine generator set with auxiliary equipment is installed for emergency use.

For purifying the lubricating oil passing through the turbine and other similar bearings, two De Laval centrifugal purifiers are installed and for measuring the depth of fuel oil in the various tanks there is an equipment of 30 pneumercator gages.

While the remaining equipment of propelling machinery and equipment is similar to that found on all first class steam vessels, the requirements of the designers and the owner's engineers have been such that much of it is of special character.

The specifications for the *Malolo* were unusually exacting, covering even the smallest and most apparently unimportant items of equipment in greatest detail. To meet



Gibbs-WEW high pressure fuel oil valve

these drastic requirements many special fittings had to be designed and manufactured, quite different and presumably better than the ordinary run of ship material and equipment. An outstanding example of this special type of equipment is found in the high pressure fuel oil valves This new valve, known as the Gibbs-WEW valve, was designed and manufactured especially for the *Malolo* by the William E. Williams Valve Corporation of New York. This valve, of which a large number were furnished to the ship, is much heavier than the valves ordinarily used for this purpose.

ELECTRIC PLANT

In common with all modern high class vessels, electricity is utilized not only for lighting but for power generation

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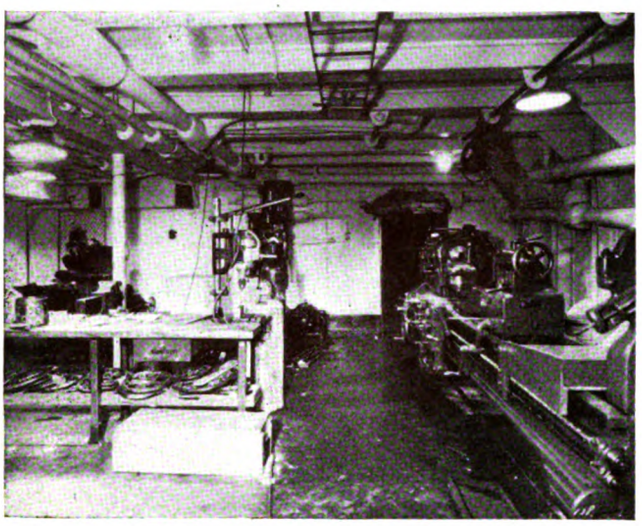
for many purposes. In addition, the extensive electric galley equipment, already referred to, requires a large amount of current, so that altogether the electric plant is a large and most important item of the ship's equipment.

The main generators, the switchboards, motors and all the principal items of the electric installation were furnished by the Westinghouse Electric and Manufacturing Company, East Pittsburgh, Pa.



Machine shop, looking aft

The main switchboard has eleven panels for the control of four 300-kilowatt, three-wire turbine generator sets, one 25-kilowatt, 120-volt emergency generator and power and lighting distribution. All panels are of ebony asbestos material. Westinghouse type CL carbon circuit breakers are used throughout, the largest of these being over 1,600 amperes. Westinghouse type SXN volt meters and ammeters are used throughout. Both the circuit breakers and meters are of a very rugged type similar to what are used on naval vessels.

Power is distributed from the main switchboard through knife switches and circuit breakers to seven centralized control panels for the auxiliary meters. These panels are in effect switchboard stations on which the magnetic type control for the group of meters served is mounted in one group of panels. There is in the engine room one of these centralized control panels respectively for the machine tools, for the engine room pumps and for the boiler room forced draft blowers. There is also a centralized group of panels for the electrical machinery in the laundry, and on deck there are three separate control panel stations to take care of the ventilation motors. These latter are installed in adequate deck houses. The panel for the electrician's use is installed in the engine room.

There are four turbo generators, each rated at 300 kilowatts, three wire 240-120 volts. They operate at 250 pounds steam pressure, 75 degrees superheat, 28 inches vacuum. They are also capable of operating against a back pressure. They are installed on a dynamo flat and exhaust downward into a common receiver pipe leading to the auxiliary condensers in their respective engine rooms, these auxiliary condensers being located fairly close to the turbine generators and underneath them.

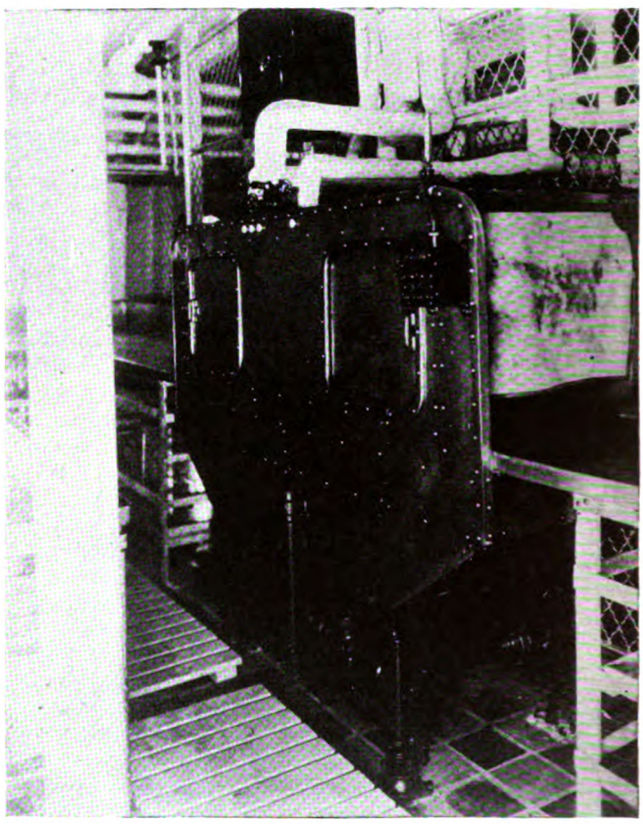
These sets are of the gear type, the turbine operating at 6,000 revolutions per minute and the generator at 900 revolutions per minute. The turbine is of the re-entry type making use of a single wheel, single case turbine. The turbines follow the Westinghouse standard marine auxiliary set design and are of rugged proportions, having the gear and turbine built as a unit and the turbine equipped with water sealed glands.

The emergency generating set consists of a Worthington, two cycle solid injection Diesel engine driving a 25-kilowatt Westinghouse generator. The engine has three cylinders 7¼ inches in diameter and 10 inches stroke and develops 50 brake horsepower at 400 revolutions per minute.

The forced draft fan motors in the boiler room and the motors in the engine room are of the Westinghouse standard self ventilated marine type equipped with sealed sleeve bearings.

The hull ventilation fan motors are all installed on the open deck and are accordingly of waterproof construction.

All the bracket fans throughout the ship were furnished by the Westinghouse Company, these being marine type fans with micarta blades. Approximately 500 of these fans are installed.



Victor dish washing machine

For emergency lighting there is installed a storage battery weighing approximately three tons and, in connection with the interior communication system, three batteries weighing 600 pounds each. All four storage batteries were furnished by the Electric Storage Battery Company of Philadelphia.

THE NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY, Cleveland, Ohio, has been awarded a contract by the Navy Department for 2¾-inch cast steel chain to be used on 5 of the light cruisers built by the Bethlehem Shipbuilding Corporation, the American Brown Boveri Corporation and the Newport News Shipbuilding & Dry Dock Company. Naco cast steel chain was also furnished on the airplane carriers *Saratoga* and *Lexington*.

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Improved Ship Design*

Relation between the ship form, inclination of struts and direction of revolution—Contrapropeller guide vanes forward and abaft the propeller—Influence of rudder form—Possible power savings for single and twin screw vessels

Dr. Ing. G. Kempf

UP to recently naval architecture has not reached the point where the design of ships' lines, particularly the after body lines, has given the most efficient propulsion. The reason for this is undoubtedly due to the fact that hull and engine design belong to two different departments and the problem involved usually has to be settled in the model basin.

The introduction of the inside drive of models (model propeller driven by motors located in the model), as compared with outside drive (model propeller operated behind through shaft and gear from motors located in the towing

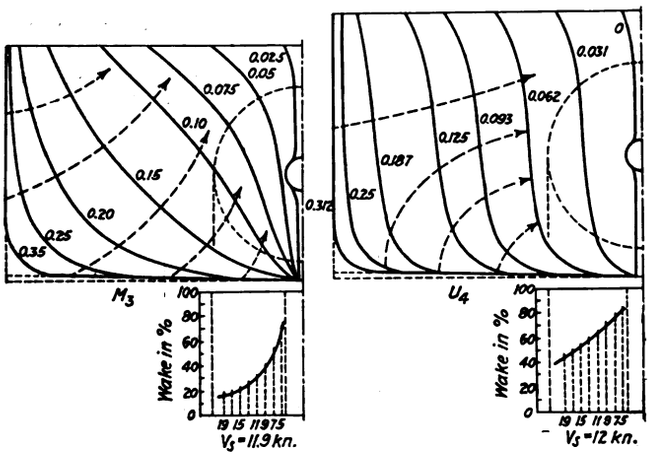

Fig. 1.—Direction of flow at after body with V shaped frames (left) and U shaped frames (right)

	V shaped frames	U shaped frames
Length between perpendiculars	129.5 m.	136.5 m.
Beam	17.05 m.	17.67 m.
Depth	7.35 m.	7.73 m.
Displacement, tons	12,510	14,412
Block co-efficient	0.768	0.765
Diameter of propeller	5,182 mm.	5,400 mm.
Pitch	4,530 m.m.	4,700 mm.
Pitch ratio	0.878	0.870

carriage), opened up new possibilities for more accurate investigations of the delicate and fluctuating relations between the ship form, propeller, rudder and guide vanes (contrapropeller). The most important, as well as the most difficult, of these is undoubtedly the ship's form. This must be laid out with the minimum resistance in view, using the principal dimensions and speed required by the contractor, which necessitates a certain fullness and displacement.

In the following, only ordinary single and twin screw ships are referred to without regard to special types; starting out with the assumption that single and twin screw drives require entirely different ship forms. To be efficient, single screw ships require U-shaped framing. Twin screw ships, however, are most efficient for relatively high speeds with V-shaped frames, whereas for low speeds the U-shaped framing gives good results also. Towing tests without propellers as a means of establishing the foregoing are unreliable and useless because the flow of the water to the propeller is influenced by its action.

In the case of U frames the water flows toward the propeller more horizontally and is more evenly distributed over the disk. With V frames, however, the flow to the upper blades is interfered with considerably. For example, a single screw ship having V frames, at small draft, will show a considerable amount of suction and poor efficiency. The U form creates an inboard flow and the V form creates an outboard flow, as indicated by Fig. 1; both absorb energy

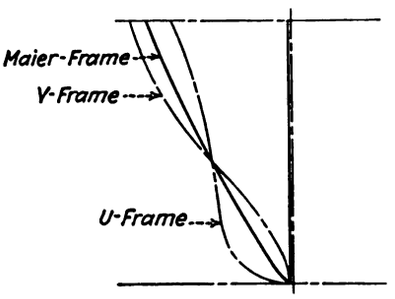

Fig. 2.—Maier framing

(resistance). It is therefore obvious that an intermediate form will absorb the least energy, as, for instance, the so called "Maier form," Fig. 2, the purpose of which is minimum residuary resistance. If the influence of the flow upon the action of the propeller is not taken into consideration, it means neglecting the ship form as well as the bossing.

The idea of utilizing this flow by diverting it into a direction opposite to the rotation of the screw propeller, in order to regain tangential losses and increase propulsive efficiency, was pointed out for the first time in Germany by Dr. Wagner before this society 20 years ago. Since then a number of designs have been evolved and adopted, the purpose of which is to regain losses forward and abaft of the propeller, the former being suggested by Prof. Hass.

Relation Between Spectacle Framing and Ship Form

For twin screw ships U framing is preferable for relatively low speeds. The inclination of the struts, however, should not be over 15 degrees and the propellers should turn outboard in order to utilize the inboard flow created by the ship form and spectacle framing.

For the position and design of the spectacle framing there are offered the following three alternatives:

(1) The bossing and framing located as parallel to stream lines as possible, and inclined 45 degrees. This arrangement gives minimum resistance and practically no diverting of flow takes place. The propulsive efficiency is therefore the same whether inboard or outboard turning propellers are used.

(2) The spectacle framing located more horizontal, the resistance increases some, an inboard flow is created; but the outboard turning propeller will utilize this flow. It is not as yet established whether V frames are more effective in connection with horizontal or inclined spectacle framing. It is known, however,

*Lecture before the technical committee of the Schiffbautechnischen Gesellschaft, Hamburg, May 12, 1927. Translated by Olav Overgaard, chief engineer, The Goldschmidt Corporation, 68 Beaver street, New York.

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that U frames in connection with horizontal spectacle frames are more efficient.

(3) Spectacle framing inclined greater than 45 degrees increases the outboard flow created by the ship's form. This requires inboard turning propellers in order to utilize the deflection. Taking the reduced maneuvering capacity, inherent to this design, into consideration, experience has proved that V framing in this connection gives the best propulsive efficiency compared with other designs.

The above has been established by a series of tests and the results are plotted in Fig. 3. V frames in connection

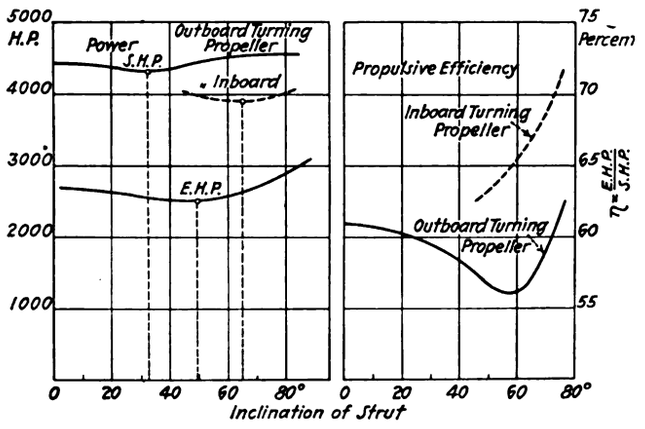

Fig. 3.—Result of test with twin screw model having V shaped after body framing

(a) Minimum E. H. P. at 50-degree inclined strut. (b) Minimum S.H.P. at 33-degree inclination of strut and outboard turning propellers. (c) Minimum S.H.P. at 65-degree inclination of strut and inboard turning propellers. (c) Shows about 10 percent less power than (b).

with spectacle framing with both inboard and outboard turning propellers have been used. Fig. 4 indicates measurements of flow taken abaft the strut by means of flow

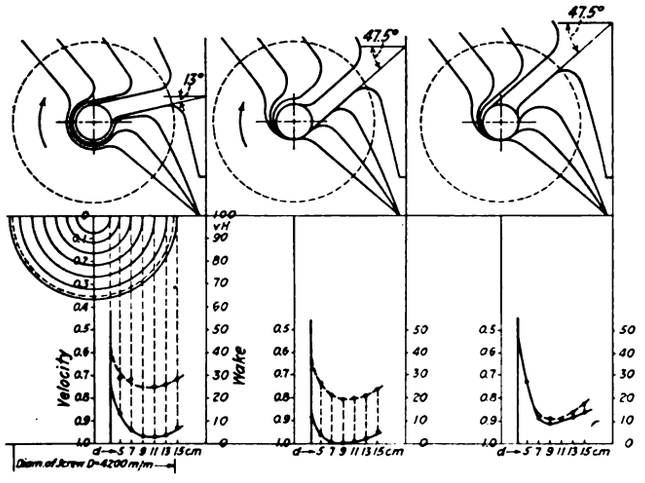

Fig. 4.—Magnitude of flow for struts of different inclination and shape

The difference measured in the middle of the wake at port and starboard by left turning current meters indicates the direction of flow following or opposing the blades of the current meter propeller. d-diameter of current meter propeller in wake.

meters. As will be seen the inclination of the struts, as well as their shape, is of considerable importance. Should the struts and framing not be designed so as to give sufficient deflection to minimize the tangential losses in the propeller jet, some desirable improvement may be realized by fitting guide vanes to the struts.

In the case of single screw ships the flow action forward of the screw can be utilized only by

(1) A body post of unsymmetrical section fairing into the lines of the vessel, or

(2) Specially designed guide vanes attached to the ordinary body post.

The idea of improving the propulsive efficiency by these means was first tested out by Professor Hass and later developed by the Star Contrapropeller Company, Norway. Such guide vanes have proved their value and are most efficient when the propeller is subjected to great loads, as for example, on tow boats. The measured gain in the model basin and in practice amounts to about 10 percent, depending upon the load on the propeller.

Guide vanes on struts for twin screw ships—so called inboard vanes—deflect the flow locally in the desired direction. Usually vanes made of steel plates, carefully curved and welded to the struts, result in 4 percent and greater gains. This gain may be increased by outboard vanes attached to strut bossing. These vanes should also be carefully designed in order that their resistance shall not exceed the gain resulting from deflection. Smooth surfaces are of importance for both types as eddies are apt to be formed reducing their efficiency.

The tangential losses of the screw amount theoretically to 7 percent, which represents the maximum gain for guide vanes forward. In most cases more than 7 percent has been realized; the addition is due to reduction of a previously existing resistance caused by eddy formation aft of the body post.

In the foregoing has been given briefly the present knowledge of the form of after body of ships. A few remarks

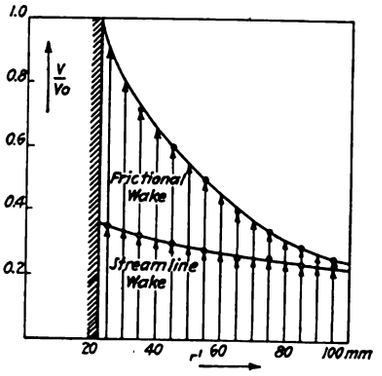

Fig. 5.—Wake behind single screw model

regarding wake and suction will serve to clarify this as well as later subjects.

The wake, due to its origin and utilization, necessarily consists of two separate units, namely, streamline wake caused by potential flow, and frictional wake caused by drag on surrounding flow (see Fig. 5). Both wakes may be measured. As has been pointed out by Fresenius and Thoma, only the energy of frictional wake can be utilized by the propeller. The more frictional wake covered by the propeller disk the greater the utilization of same. For torpedoes the drive conditions are ideal because the area of the disk equals that of the midship section.

When designing the after body it is therefore of importance to guide the wake as concentrated as possible to the propeller disk. The ship form, in order to create the least possible suction, should be as far from the screw as possible. Rear Admiral Taylor has investigated this for one single screw ship form in connection with three different sizes of propeller at six different positions. The results indicated that the smaller propeller was the most efficient when located as high as possible and reasonably close to the body post. The difference in efficiency between different arrangements and locations may exceed 30 percent, according to Admiral Taylor's investigation.

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When referring to twin screw ships in this connection, the problem is different. The potential flow is here the greatest one in the vicinity of the propeller, and the possibility for utilizing the wake is therefore less and in most cases only 5 percent may be expected. Whether it will be worth while to design the twin screw ship form in accordance with this depends on further research. This was started four years ago but discontinued owing to lack of funds and time.

In connection with the present twin screw ship's form, it is impossible to utilize the wake to any great extent. For identical ship forms the twin screw drive is not as efficient as the single screw drive. This is a well known and proved

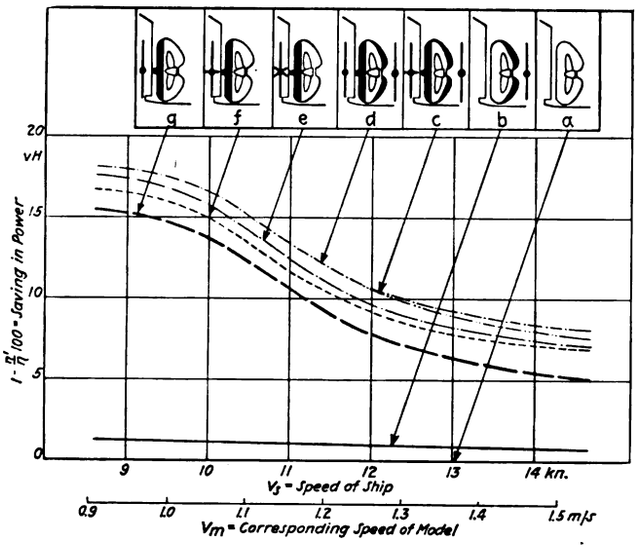

Fig. 6.—Gain obtained by different types of contrapropellers

(a) Self-propulsive test without contrapropeller. (b) Self-propulsive test with contrapropeller guide vanes on body post (not fair owing to lack of space). (c) Self-propulsive test same as (b) and 4-bladed contrapropeller abaft screw. (d) Self-propulsive test same as (b) and 2-bladed contrapropeller abaft screw. (e) Self-propulsive test 6-bladed contrapropeller abaft only. (f) Self-propulsive test 4-bladed contrapropeller abaft only. (g) Self-propulsive test 2-bladed contrapropeller abaft only.

fact and has been clearly established by our statistics gathered from tests showing the power required. In accordance with this, the average efficiency is 10 percent less than that of a single screw ship which also has been recently verified by Schlupp.

The screw propeller itself has been treated thoroughly hitherto and it suffices here to say that this must be designed theoretically and practically in accordance with the established experience and corresponding flow condition around the ship.

DESIGN OF SHIP'S FORM AFT OF PROPELLER

Dr. Wagner's suggestion of deflecting the propeller jet by stationary guide vanes (contrapropeller) in order to regain the tangential losses is here of the most importance. This suggestion not only resulted in the expected improvement for single screw ships but has shown a surprisingly large gain. The saving in power not only amounts to the theoretically expected 7 percent but usually to 12 percent and more. This saving was so considerable that it was doubted to begin with. It cannot, however, be denied as it has been verified by experience and model test on a large scale. The saving may be accounted for in the following manner:

(1) Regaining of tangential losses. This is the more efficient the more ideal the ability of deflection is, and usually amounts to 7 percent. The actions of contrapropellers with different numbers of blades, i.e. 6, 4 and 2, have been investigated in connection with different models and a number of ships in operation. Although it has been shown that the 6 bladed type results in about 2 percent better efficiency than the 4 and 2 bladed types, the latter types are preferred for practical reasons.

(2) A reduction in resistance caused by the stern post (usually of rectangular section) located in the propeller jet. This reduction amounts up to 5 percent of the total resistance of the ship.

(3) A reduction in propeller suction, the cause of which is not thoroughly understood but which may be explained partly by the reduction in revolutions noted when the contrapropeller is used. The reduction of propeller suction can, in accordance with experience with single screw vessels of full lines, be of considerable magnitude.

Assuming 5 percent as average for each of these three effects, i. e. regaining of tangential losses, reduction in resistance and reduction in suction, the total saving of power amounts to 15 percent which, for the same power, corresponds to an increase of speed of about 7 percent. Fig. 6 shows the result obtained by testing different types of contrapropellers in connection with a single screw ship belonging to the Isthmian Lines, New York. As indicated, a combination of 4-bladed contrapropeller and guide vanes on the body post gave the best result. At 11.5 knots the saving in power amounted to 11.5 percent. This saving is, according to the owners, also the average shown in operation. In addition to the power saving characteristics of the contrapropeller, it also to a considerable extent improves the steering of the ship.

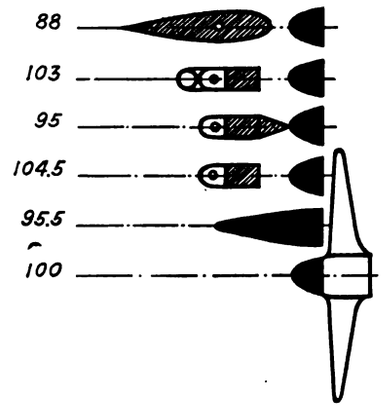

Fig. 7.—Comparison of power required at same speed by various hubs, stern posts and rudders

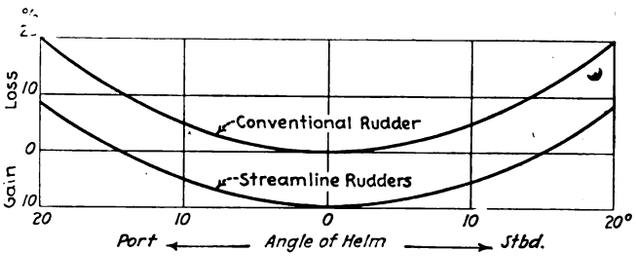

Fig. 8.—Influence of rudder form and position on drive

While the contrapropeller, aside from regaining tangential losses, also causes a reduction in resistance and suction, these two latter benefits may be realized by a body of symmetrical section in the propeller jet, although the utilization of tangential losses of such a body is negligible. Symmetrical streamline rudders, as, for example, the Flet ner rudder, Oertz rudder and balanced rudders of streamline shape, show in the model basin and also in operation a fair saving in power as compared with the ordinary plate rudder. This amounts in some cases to nearly 10 percent (see Fig 8). The great thickness of the section of these types of rudders as compared with the ordinary rudder probably

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also acts favorably on the suction and reduces this. The distribution of pressure of the different systems—i. e. ship's form, screw and rudder is effected favorably. That the Flettner rudder and Oertz rudder, as well as the contra rudder (not described here) improves the steering has been proved time and time again. This undoubtedly is the cause of an increase in speed, especially in bad weather.

EFFECT ON TWIN SCREW SHIPS

So far it has been impossible to measure any favorable effects in connection with twin screw ships due to these rudders. It therefore appears that their field is limited to single screw ships only, where properly shaped rudders are of more importance.

While the efficiency for twin screw ships apparently can

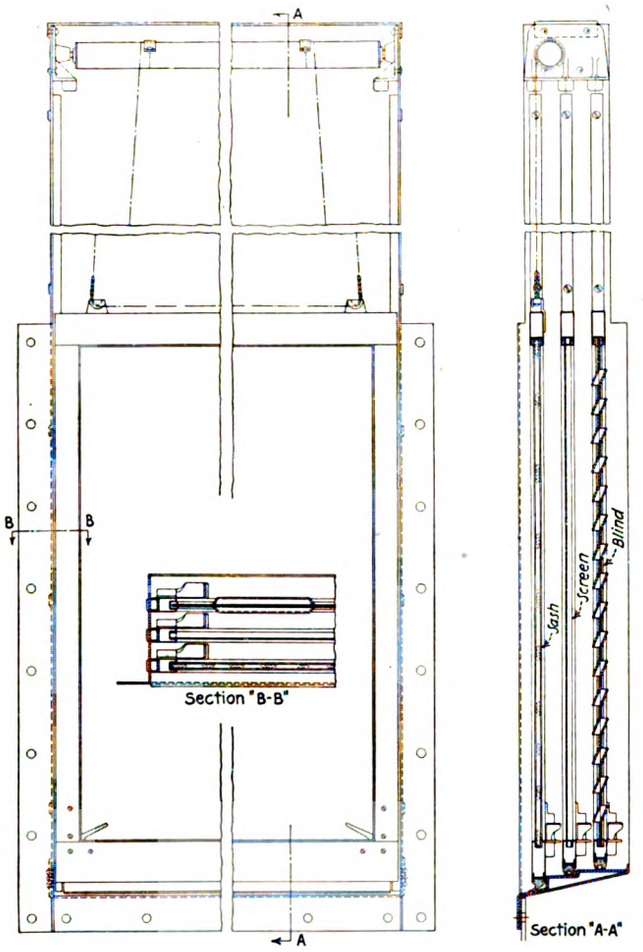

Fig. 1.—Details of construction of Edwards metal window frames and sashes

be improved only by about 7 percent with properly designed struts, guide vanes and the correct direction of revolution of propellers, the contrapropeller in connection with single screw ships may result in 15 percent saving; a combination of contrapropeller and streamline rudder in even more. Therefore, the single screw ships should be the most efficient. The statistics gathered in model basin tests within the last 5 years indicate that a quasi-propulsive efficiency of about 65 percent may be reached for twin screw ships, while 70 percent and more may be obtained for single screw ships.

While, in later years, we have seen many improvements in the efficiency of propulsion of vessels established by practical tests, there is still room for improvements and theoretical research.

Edwards Metal Window Frames and Sashes Installed on the Dixie

THE O. M. Edwards Company, Syracuse, N. Y., has supplied 180 metal window frames and sashes for installation in the public rooms and staterooms on the boat and promenade decks of the new coastwise liner *Dixie* now under construction at the Federal shipyard, Kearny, N. J., for the Southern Pacific Steamship Company, New York. The construction of these windows is shown in Fig. 1.

All parts of the frames and sashes are made of brass or bronze to prevent corrosion due to salt air. Each window

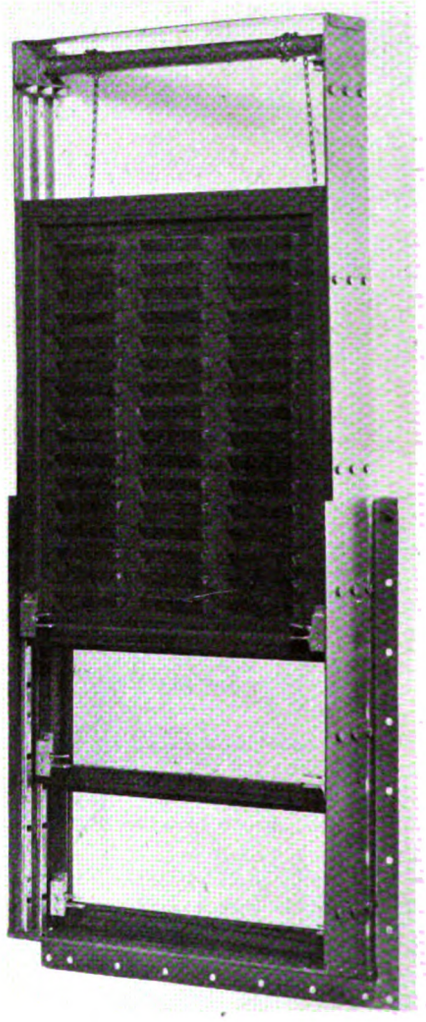

Fig. 2.—One of the Edwards windows for the *Dixie*, showing the window closed, the screen partly raised and the blind fully open

is fitted with three sashes, approximately 20 by 24 inches. The outside sash is glazed with ¼-inch plate glass and on account of the weight of the glass is provided with a spring roller balance, the tube in which the spring is encased being packed with vaseline to prevent rusting. In Fig. 2 this sash is shown in the closed position. The center sash is equipped with a screen and the inside sash with a louvre blind. No balance is required for the screen or blind.

These frames and sashes are finished in grained mahogany and quartered oak to match the finish of the rooms in which they are installed on the ship.

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Flettner Rudder Demonstrated on Destroyer Converse

AN instructive demonstration of the action of the Flettner rudder was given to a party of New York shipping men on October 7 on board the U. S. destroyer *Converse*, which is the first American vessel to be equipped with this type of rudder. This installation was made by the Navy Department for experimental purposes. As this type of rudder swings through a complete circle of 360 degrees it could not be fitted in the same position

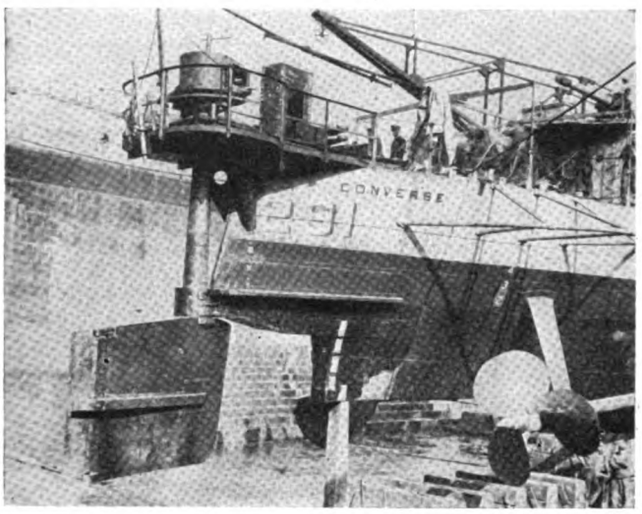

Fig. 1.—Temporary installation of Flettner rudder on the U. S. S. Converse

as the ordinary rudder without rebuilding the stern of the vessel, so that in this case, as shown in Fig. 1, the rudder was fitted by means of a special structure built over the stern of the vessel.

Off the entrance to New York harbor the *Converse* was put through the following maneuvers: the rudder was put hard over, right and left, while the vessel was running at speeds of 15, 20 and 25 knots, respectively; the vessel was slowed down to a speed of 1 knot to show the maneuvering ability of the rudder at low speeds. The engines were also reversed, sending the vessel astern at speeds of 5 and 15 knots. At a speed of 25 knots the rudder was put hard over in from 5 to 7 seconds and the turning circle of the ship was reduced about 33 percent.

Among the most important features of the rudder demonstrated in these tests were its extreme sensitiveness to control and its flexibility and automatic response under the effect of waves or currents. The rudder was shown to be effective whenever a current of water was available for acting on the rudder, due either to the motion of the ship, no matter how slow, or to the turning of the propellers.

The Flettner rudder is characterized by two features: (1) the main rudder is free to swing through a complete circle about its turning axis and (2) attached to the trailing end of the main rudder is a small auxiliary rudder, the so-called Flettner fin. This fin is hinged to and may be swung into any desired angle with respect to the main rudder by means of mechanism which by ordinary means, such as wire rope, telemotor, etc., transmits motion from the wheel on the bridge to the fin shaft, the latter being rotatable inside the hollow main rudder stock. The yokes and rods connecting the fin shaft to the fin are enclosed in the hollow streamline main rudder.

From the above it will be seen that the helmsman controls the fin only and the latter in turn controls the main rudder. When the fin is put at an angle with respect to the main rudder the current of water created by the motion of the vessel, or the propeller stream, builds up positive pressure on one side and negative pressure or suction on the other, and the resultant pressure, acting with the distance between the center of fin pressure and the turning axis of the main rudder as a lever arm, sets up a moment which tends to swing the main rudder about its turning axis. The main rudder will continue to turn until equilibrium has once more been established; that is, until the resulting moment due to the action of the current on the main rudder balances the moment built up by the fin.

The area of the fin being but a fraction of the area of the rudder, very little energy is needed to manipulate the fin and thereby the rudder, so that the customary steering engine may either be altogether dispensed with or replaced by a small electric motor.

Vessels up to 9,000 tons deadweight, fitted with Flettner rudders, have been successfully steered by hand power only. On the *Converse* a 1 horsepower electric motor takes the place of the former 35 horsepower steering engine. The *Converse* is steered by hand up to a speed of 18 knots. At higher speeds the small electric motor is used, although for ordinary service, i.e., when not in fleet maneuvers, hand operation is perfectly satisfactory up to 30 knots and even

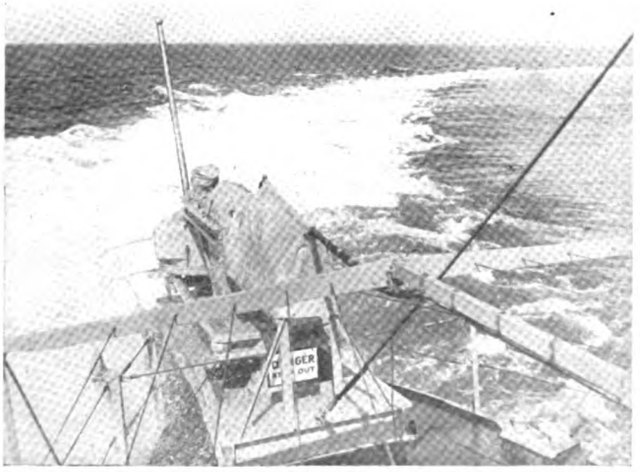

Fig. 2.—The Converse making a turn at full speed with the rudder hard over

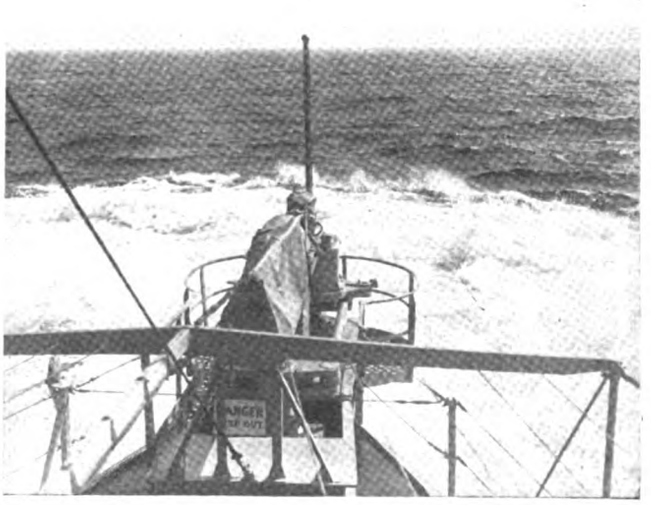

Fig. 3.—The Converse going astern

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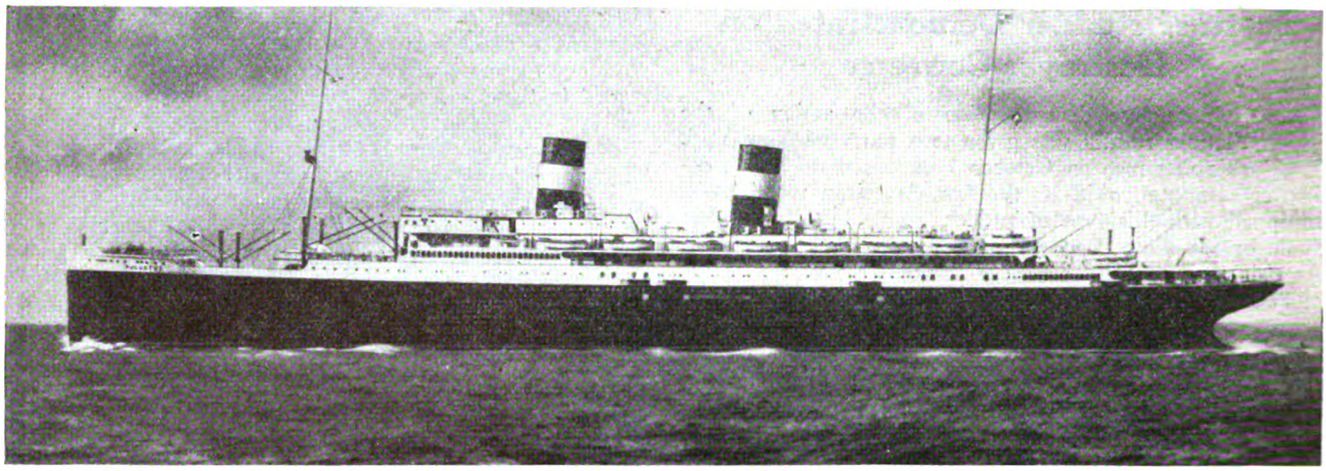

Italian motor liner Augustus, the largest of her type in the world: Gross tonnage, 32,500; shaft horsepower, 25,000; speed, over 20 knots

preferred by the steersman, because he can "feel" the rudder.

While the mechanism which actuates the fin is sufficient to steer the ship, another valuable feature is obtained with the Flettner rudder, which automatically, that is, without the assistance or even the knowledge of the helmsman, returns the rudder to the position at which it was set by him, whenever variations in the current or the impact of waves throw the rudder out of position. This automatic action is generally but not necessarily brought about by means of cams which permit the designer to adapt the rudder to a wide range of requirements as to sensitiveness, etc.; for instance, the fin is usually made to turn relatively very quickly near the midship position of the rudder, the angle of deflection decreasing as the rudder nears the hard over position.

When the vessel is moving astern the rudder swings through 180 degrees. This action not only eliminates the heavy torsional stresses to which the old type rudder is subjected when the ship is moving astern with the rudder hard over or nearly so, but it also, on account of the rudder trailing, enables the vessel to be steered just as well going astern as going ahead.

During the last four years vessels of various types and sizes have been successfully equipped with Flettner rudders ranging from small motor boats to sea-going vessels up to 9,000 tons deadweight and from slow river barges to the fastest destroyers. More than 100 barges, ferry steamers and other river craft plying in narrow crowded and treacherous waterways, such as the Rhine and Danube, have been successfully equipped with this type of rudder.

On the demonstration in New York harbor Lieutenant Thomas F. O'Brien, of the Bureau of Construction and Repair, Navy Department, explained the details of the installation on the *Converse*, and Mr. F. O. Willhofft, vice president of the Flettner Corporation of America, 68 Beaver Street, New York, pointed out the advantages of this type of rudder as applied to merchant vessels. Lieutenant Commander Wells E. Goodhue was in command of the vessel.

The Augustus, the World's Largest Motorship

THE largest motorship in the world, the *Augustus*, started on her preliminary trials in October and the sailing date for the maiden voyage is November 10. It will be recalled that she is 706 feet in length with a beam of 82 feet 6 inches, and has a gross tonnage of 32,500, while the machinery power is larger than that fitted in any vessel, totaling 25,000 shaft horsepower in normal service and 28,000 shaft horsepower as a maximum.

As the illustration shows, she has two funnels and is, in outward appearance, exactly similar to a steamer of the same size. The forward funnel is utilized for accommodating the silencers for the eight auxiliary engines which are fitted in the vessel, as well as the uptakes from the two horizontal boilers, while in the after funnel are four separate silencers for the propelling engines. These motors—four two-stroke M.A.N. double acting 6,250 to 7,000 brake horsepower units—have, however, a secondary silencer in each case, fitted in the engine room, so that it is anticipated exceptional silence of the exhaust will be attained.

The auxiliary engine room is forward of the main machinery space and the eight auxiliary generators mentioned above comprise three of 600 kilowatts and five of 300 kilowatts. The boilers are fitted in a special boiler room forward of the auxiliary engine room.

The *Augustus* has been designed to give a speed in service of over 20 knots.

Program of Naval Architects' Annual Meeting

THE thirty-fifth general meeting of the Society of Naval Architects and Marine Engineers will be held in the Engineering Societies Building, 29 West 39th Street, New York, on Thursday and Friday, November 10 and 11. The professional sessions will begin at 10 a. m. each day and the annual banquet will be held in the Grand Ball Room of the Waldorf-Astoria hotel on Friday evening, November 11, at 7:30 o'clock.

Prior to the general meeting, the council of the society will meet at 3 p. m. Wednesday, November 9, in the Board Room of the American Society of Civil Engineers on the 15th floor of the Engineering Societies Building.

The following papers will be read at the professional sessions of the society:

THURSDAY, NOVEMBER 10

"Car Float Strength and Deflection." By Professor Evers Burtner and Richard H. Tingey.

"The Design of Superstructures for Large Passenger Ships." By Carl E. Petersen and Lorentz Hansen.

"The Wampanoag, the Fastest Ship in the World, 1868." By James Swan.

"The Submarine of Today." By Lawrence Y. Spear.

"Model Tests with Adjustable Blade Propellers." By Captain William McEntee, (CC), U. S. N.

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"Tank Steamer Fires and Explosions." By Robert L. Hague.
"What is Naval Aviation Doing." By Captain Emory S. Land, (CC), U. S. N.

FRIDAY, NOVEMBER 11

"Test of Pulverized Coal as Applied to Scotch Marine Boilers." By Carl J. Jefferson and Commander Joseph S. Evans, U. S. N.
"Pulverized Coal Tests of a Marine Watertube Boiler." By Thomas B. Stillman.
"Test of a Two Cycle Double Acting Marine Diesel Engine." By Ernest Nibbs and Stephen A. Gardner.
"Diesel Engines for the Navy." By Edward C. Magdeburger.
"The Engines of the U. S. Shipping Board Diesel Conversion Program." By Captain Richard D. Gatewood, (CC), U. S. N.
"Modern Trend of the Diesel Engine with Respect to Low Weight per Horsepower, High Revolutions per Minute and High Mean Effective Pressure." By Otis D. Treiber.
"Vibration and Engine Balance in Diesel Ships." By Professor Frank M. Lewis.

New Bessemer Diesels of Unique Design

R-line straight eights and sixes built for marine service follow automotive practice—Details of construction

THE new Bessemer R-line of Diesel engines are unique in engineering features and have been so designed as to secure the utmost in compactness without sacrificing strength and at the same time increasing mechanical efficiency. They are characterized by unusual freedom from vibration and noteworthy simplicity.

As the illustrations show, these new Diesels are strongly reminiscent of automotive practice and a detailed study shows the close following of automotive practice throughout.

While the cylinders are cast en-bloc, a high degree of accessibility is secured by the use of individual cylinder heads which can be removed to give ready access to the individual cylinder liners. This practically eliminates the necessity for dismantling the cooling water connections or valve operating gear.

The bases of the engines are built in two sections of three or four cylinders each, with all base castings and other castings made of steel or semi-steel. This feature adds to the torsional rigidity of the engine and permits a reduction in the overall dimensions.

A barring-over-device consisting of a pinion on the crank shaft operated by a worm gear, which in turn can be moved from the outside by a ratchet wrench, is mounted on the forward end of the base. This barring gear can be supplemented with a motor drive if desired. At the rear of the engine is located the fly wheel and overspeed governor and a Kingsbury thrust bearing.

The crank shaft is forged in two sections, each serving one block of cylinders. The main bearings and crank bearings are unusually large, the 8 cylinder engines having bearings 12¾ inches in diameter.

It has been found in a series of exhaustive tests that there are no critical speeds up to 350 revolutions per minute. In tests with the 8 cylinder engine at the normal speed of 300 revolutions per minute the operation of the engine is as quiet and relatively free from vibration as the most delicately balanced 8 cylinder automobile engine.

At the center of the crank shaft coupling in the middle of the engine is mounted a pinion which operates the chain drive to the overhead cam shaft through a 2-to-1 reduction gear.

The two center frame housings or water boxes, each enclosing four cylinders, are of H type construction. The cylinder liners are of semi-steel and are bored and ground to a smooth finish. A copper-asbestos gasket is fitted at the top of the liner, and at the bottom is a rubber gasket fitted with a removable gland for sealing the water circulation space in the center frame. Eight large cleanout plates are located at equal intervals along the center frame.

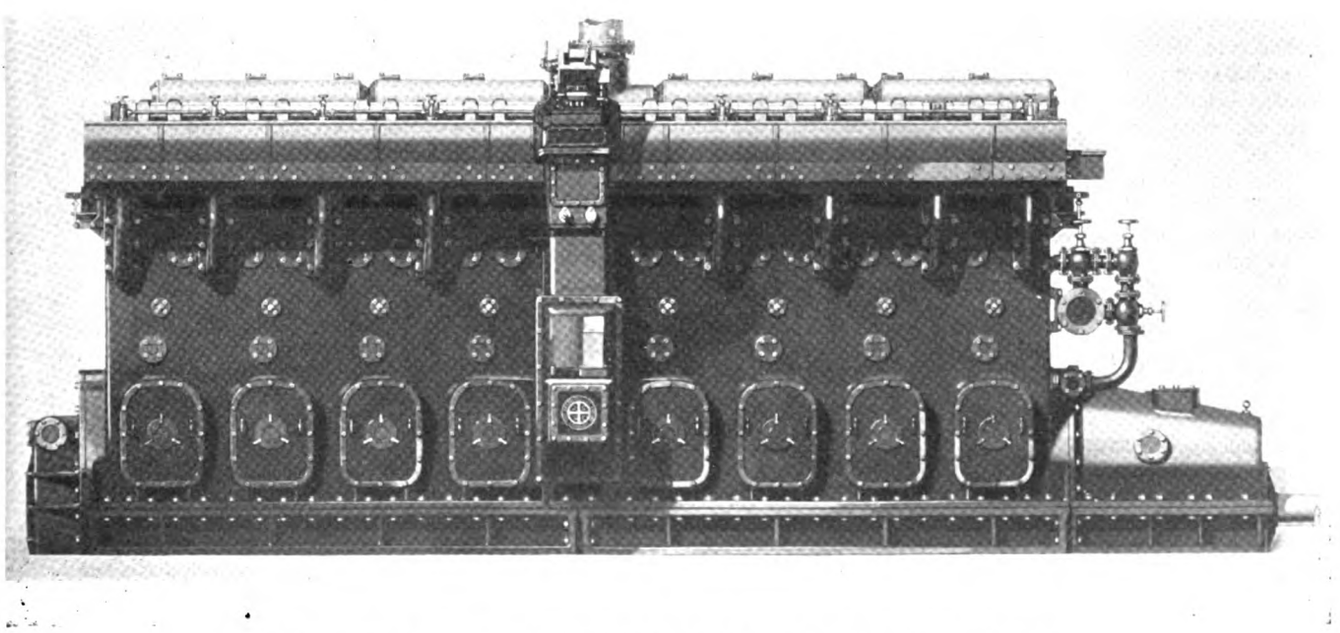

Fig. 1.—The new Bessemer straight eight R-line marine Diesel engine

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Above these plates are located the lubricating oil leads through which lubricating oil is furnished to the cylinder walls by special Manzel timed lubricators.

The pistons are made of Bu-nite nickel alloy with four steel bands cast internally to provide a guide for the expansion of the heated piston metal.

The wrist pin bearings are 8⅞ inches in diameter and the connecting rods are of forged steel machined all over.

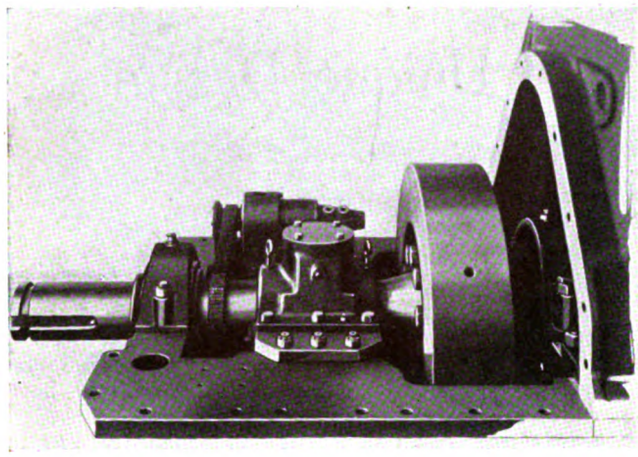

Fig. 2.—After end of engine showing Kingsbury thrust and steady bearing, small size fly wheel and silent chain driven overspeed governor. This entire assembly is enclosed with a tight fitting case

The bearings are of cast steel with removable shells which are babbitted by a centrifugal process.

The construction of the cylinder heads is shown in Fig. 3. It will be noted that an excellent distribution of material has been obtained by the use of dual valves, greatly reducing the liability of thin sections in the cylinder head castings. The heads are also baffled internally to assist the distribution of the cooling water and relatively large clean-out plates are provided for access to the water space. The circulating water is taken from the jackets in the head to the jackets surrounding the cylinder liners by passages located at four points equidistant around the circumference of the head.

The overhead cam shaft is supported by brackets bolted to the cylinder frame and attached to each of these brackets is an additional cast upright which supports the rocker arm shaft. Each pair of valves is operated by a single rocker arm which transmits its impulse to them through a hinged bridge.

The fuel injection valve, located on the axis of each cylinder head, is operated by an inclined push rod which rides directly on the cam shaft. An auxiliary shaft which is mounted parallel to the cam shaft controls the movement of this push rod when the overspeed governor is brought into play. The governor gear is an example of the growing application of ball bearings to oil engines, as the linkage and shafts are entirely supported on bearings of this type.

An air starting pilot valve on each cylinder head is also operated by the cam shaft. These pilot valves open the main air starting valves to each cylinder at the proper time for starting and are automatically closed when the engines begin to operate on fuel. The relief valves are mounted as usual on the side of each cylinder head.

For reversing in marine service the cam shaft is mounted on eccentric bearings, the rotation of which permit the shaft to be disengaged from the rocker arms and moved laterally in order to bring the reversing cams into position.

Movement of the cam shaft is carried out by an air ram mounted in the center of the engine in the same plane as the chain and pinions which operate the cam shaft. The piston of the air ram is direct connected to a rack which rotates the cam shaft and also brings into play a grooved cam, supplying the impulse for bringing the reversing cams into position.

The air starting valves, the air ram described above and the fuel pumps are all controlled by a lever which works in a U-shaped slot mounted at the top of the control housing. At the base of the U the air starting valve is opened. As the lever is moved up the slot, the volume of starting air is gradually increased and the fuel pumps are then brought into play as the control lever progresses through the full length of its swing. During this operation an additional factor of safety is provided by a lock on the control lever which must be depressed before it passes to the point where fuel is admitted.

Reversing the movement of the lever gradually cuts off the supply of fuel and the lever is shifted to the opposite limb of the U, where a similar air starting impulse is given in the reverse direction, this being followed with an increase in the fuel supply in exactly the same manner as described above.

Auxiliary Equipment

The fuel pumps, mounted directly on the center frame, are operated by a pinion engaging with the cam shaft drive. All other auxiliary pumps and compressors are operated as independent units.

The circulating pump for the water cooling system is a DeLaval unit direct connected to a 7½ horsepower motor mounted on a unit sub-base.

A Schutte-Koerting oil cooler and an oil strainer of similar make is also mounted on the fly wheel end of the engine.

The auxiliary compressors for furnishing maneuvering and starting air are Ingersoll-Rand 2-stage 21 cubic feet capacity units, also operated by motor drive.

For marine installation, auxiliary generating equipment, consisting of two 6-cylinder model F-6 Bessemer Diesels

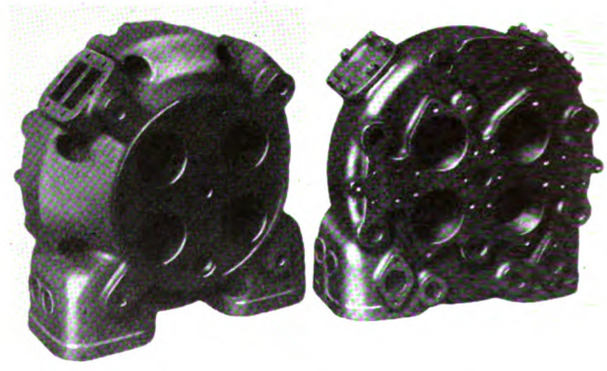

Fig. 3.—Cylinder head, showing dual intake and exhaust valve openings. A baffle plate in the water openings assures perfect circulation to the center of the head

direct connected to 110-kilowatt Westinghouse generators are supplied, in addition to one type E-3 3-cylinder Bessemer Diesel rated at 60 horsepower direct connected to a 40-kilowatt Westinghouse generator.

The marine practice followed in installing these engines also calls for water pumps and lubricating oil pumps which are of an individual capacity large enough to serve two engines in the event that one of the units breaks down.

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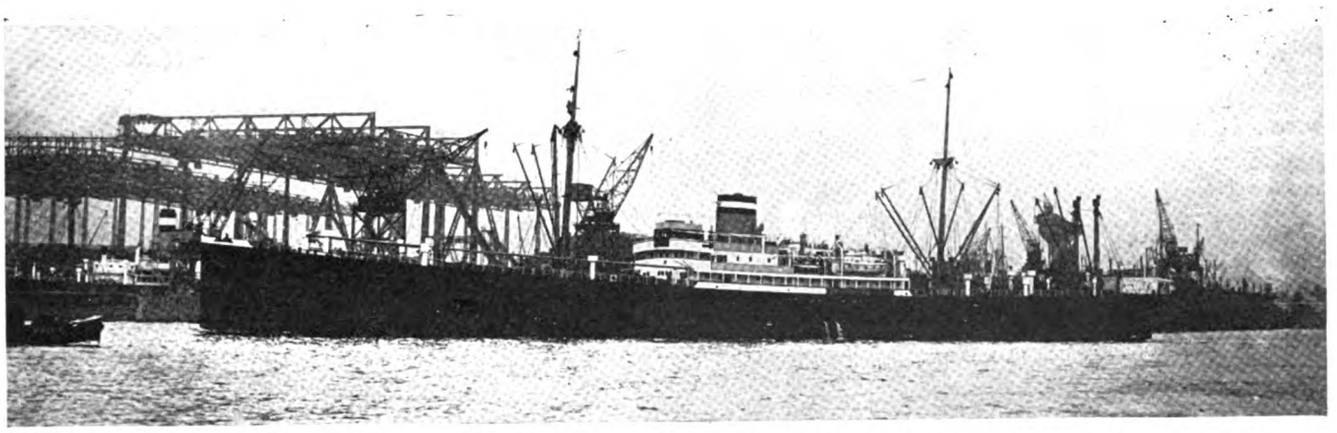

The Hamburg Amerika Line motor cargo ship Rheinland

Latest British and German Standard Motorships

Particulars of the Hamburg Amerika Line's Rheinland and the Furness Withy & Company's Pacific Reliance

By Our Special London Correspondent

AMONG the big shipowning companies in Europe, it has become common, when deciding to contract for new tonnage, to order several vessels, and frequently these are of a standard type. This is specially advantageous when it is a question of building oil-engined craft, since the standardization of the machinery enables it to be constructed at a lower price, and helps greatly in regard to the question of spare parts. Moreover, it is easier to transfer engineers from one ship to another, and if the type of motor installed is one with which considerable satisfactory experience has been gained, the owners are relieved from any fears with regard to its operation.

Among the important shipowning concerns which have adopted this policy of laying down a number of standard ships are Furness Withy & Company, the King Line, and the Silver Line, in England, the Rotterdam Lloyd and the Netherland Steamship Company, in Holland, and the Hamburg Amerika Line in Germany. Two of these standard ships have just been completed, one, the *Pacific Reliance,* the first of four ordered by Furness Withy & Company for their trade between London and the West coast of North America via the Panama Canal, while the other is the *Rheinland,* which has recently sailed on her maiden voyage to the Far East, the owners being the Hamburg Amerika Line.

In the case of all the ships referred to, relatively high speeds have to be maintained, and the minimum is 13 knots, while in certain vessels as much as 14½ knots loaded speed at sea is specified.

The Rheinland

The *Rheinland* is notable as being the first of eighteen motorships of various types which the Hamburg Amerika Line is building under its new programme. These include numerous passenger as well as pure cargo ships and two of them are 17,000-ton transatlantic liners. Several are to trade to the Pacific coast, some to Australia or the Far East and others to the West Indies, so that, in due course, a large portion of the globe will thus be covered by Hamburg Amerika Line oil-engined vessels.

The *Rheinland* is one of seven vessels for the same owners building at Hamburg by the Deutsche Werft.

The following are the main dimensions:

Length over all	468 feet 6 inches
Length between perpendiculars	450 feet
Beam molded	59 feet 1 inch.
Depth to main deck	29 feet 6½ inches
Depth to shelter deck	37 feet 6 inches
Draft	25 feet 6 inches
Deadweight capacity	10,300 tons
Speed	13/14 knots
Gross tonnage	6,622

She is constructed as a single screw ship with three holds forward and three aft of the engine room, a deep tank being arranged for the carriage of cargo oil. In view of the long distance trade on which she will be engaged, the fuel capacity is on an exceptionally large scale, for about 900 tons of oil can be carried in double bottom tanks, and 850 in two deep tanks forward of the engine room. This is sufficient for about 80 days operation at full speed, so that the ship could cover a distance of 25,000 sea miles without rebunkering.

The cubic capacity of the holds is equivalent to 612,107 cubic feet of grain or 555,813 cubic feet of bales. The accommodation for the crew is located above the engine room, the engineers being berthed around the engine room casing and the deck officers on the boat deck.

The cargo handling gear calls for some comment as the six hatchways are served by no fewer than 18 electric winches, four of the 7-ton type, and the remainder capable of lifting 3 tons. The anchor windlass and the steering gear are electrically operated, the latter being worked on the Ward Leonard principle.

It is claimed that with the new type of rudder introduced in the *Rheinland* a high propulsive efficiency is attained. It is of a design of the hull builders, and one advantage is stated to be that it can be operated at much lower power than the ordinary type, and, in fact, on trials, it was demonstrated that it could be actuated by hand.

Machinery

A large proportion of the new motorships for the Hamburg Amerika Line are to be equipped with double acting, two stroke motors, and their operation in cargo vessels, compared with that of the single acting type, will be a

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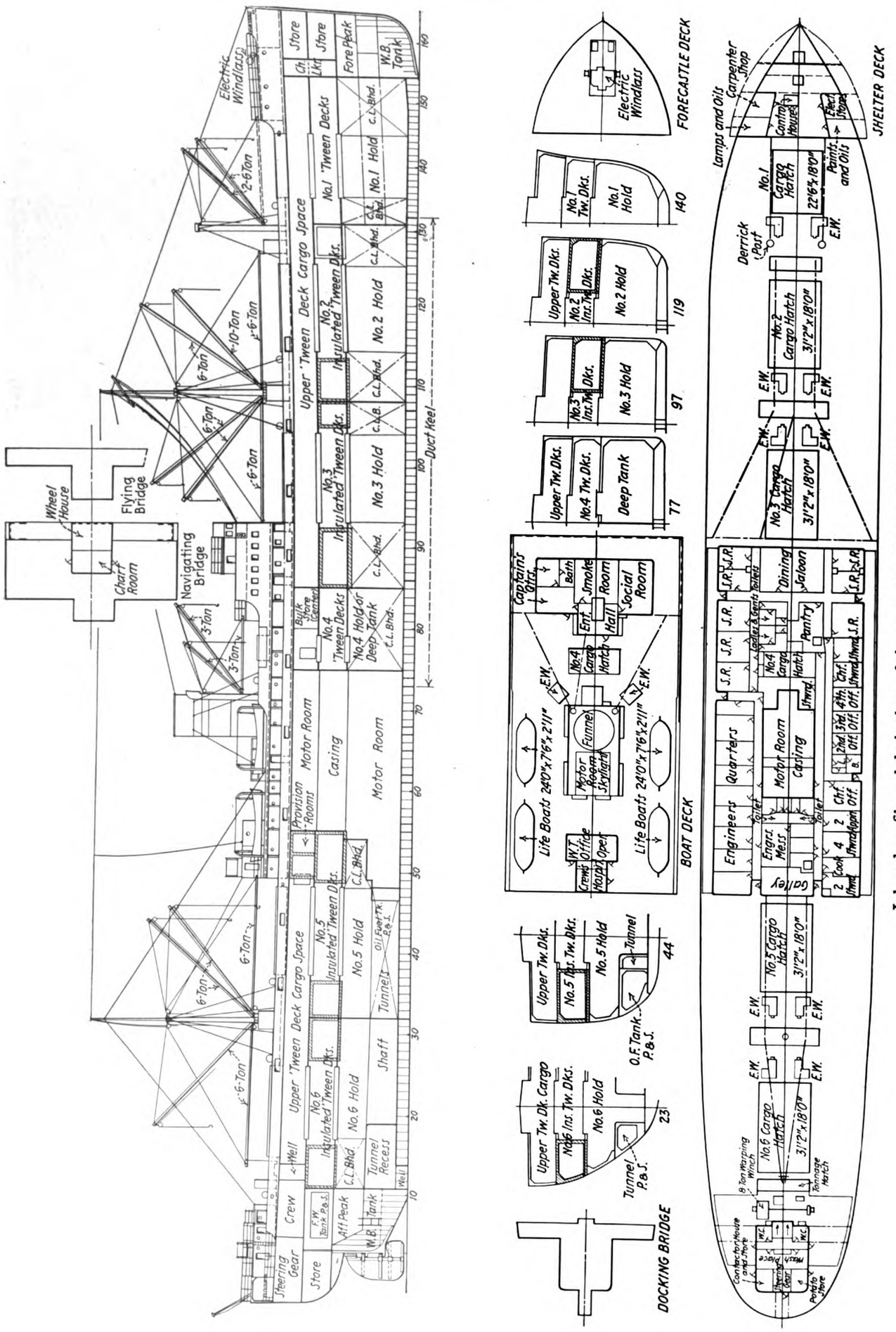

Inboard profile and deck plans of the motorship Pacific Reliance

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matter of considerable interest. The *Rheinland* is fitted with a standard engine, of which type seven or eight are to be installed in the different Hapag ships. It is a six cylinder unit, with cylinders 700 millimeters bore and a piston stroke of 1,200 millimeters; it develops 4,500 shaft horsepower at 86 revolutions per minute. It may be noted that the cylinder dimensions of this motor are exactly the same as that of the four engines installed in the world's largest motor liner, the *Augustus,* where four six-cylinder units of the class are used. The speed of the motors in the big liner is, however, considerably greater, being 120 revolutions per minute normally, with a maximum of 125 revolutions per minute.

The design of the M.A.N. double acting, two stroke engine is now well known, and it is, in fact, identical with the type built by the Hooven, Owens, Rentschler Company, and the New London Ship and Engine Company, except that in the *Rheinland* the scavenging blower is separate from the main engine, taking the form of an electrically driven blower.

Those engineers who have examined the American built engines will, however, note one modification, namely, that from the cam shaft there is only one vertical push rod for operating the valves at the top of the cylinder cover. This is due to the fact that in the *Rheinland's* engine the starting air valves are located only at the bottom, and those originally fitted at the top of the engine are omitted. This is advantageous from the standpoint of simplicity and it is stated that the results achieved by adopting such a system are quite satisfactory.

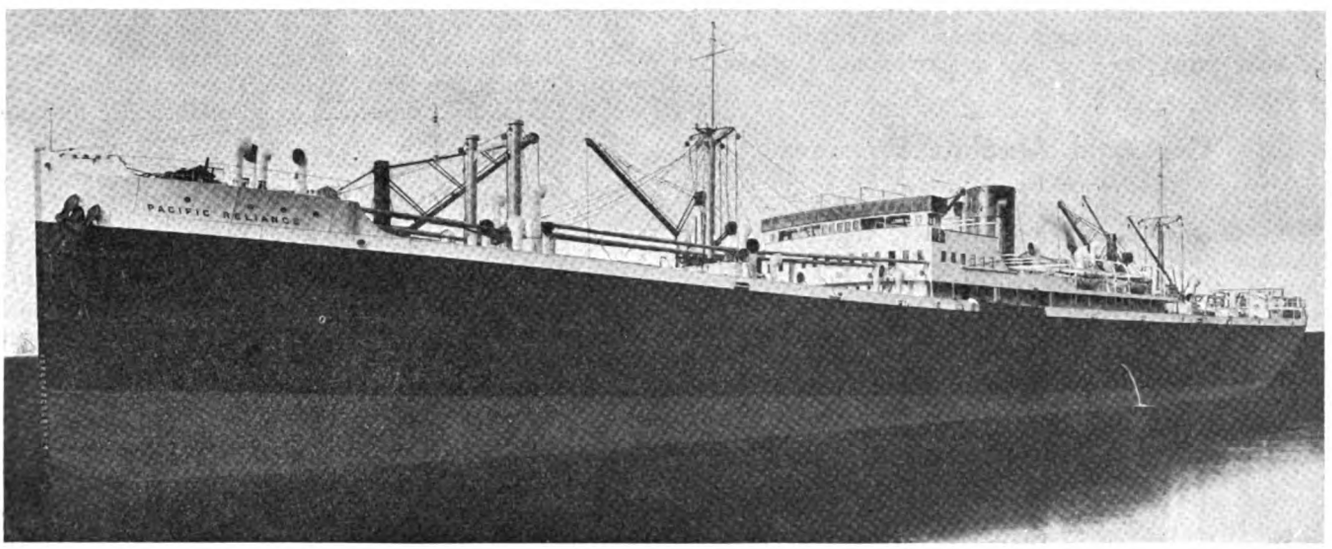
Installed in the engine room on the port side are three Diesel dynamos of 200 kilowatts running at 225 revolutions per minute. On the starboard side at the forward end are the two electrically operated scavenging blowers of 23,000 cubic feet capacity per minute. In addition, there is one electrically driven auxiliary compressor and the usual engine room and ship's pumps. The total length of the engine room is somewhat over 50 feet. As it is generally thought that the heat in the exhaust gases of two stroke engines is not sufficient to be utilized for heating water or raising steam, it is of interest to note that in the *Rheinland,* the exhaust is passed around a waste heat boiler, which is able to heat the circulating water to a temperature of 90 degrees, and this is used for general heating purposes on the ship.

The four new standard ships for Furness Withy & Company, are being built on the Clyde at the Blythswood yard and are similar in every respect. They are not unlike the five Prince Line motor vessels constructed a year or two ago in Germany, but the power is lower and the designed speed is 13 knots. The main particulars follow:

Length over all	450 feet
Molded beam	60 feet 1 inch
Depth	42 feet
Draft	27 feet 5 inches
Deadweight capacity	10,000 tons
Gross register	6,716 tons

There are, in all, five holds, but one can be used as a deep tank. In the 'tween decks of each hold is arranged a substantial amount of refrigerated space in which it is intended to carry fruit from California to England. Twelve electrically driven winches are installed, two of 5 tons and ten of 3 tons, and all auxiliary plant, including the CO_2 refrigerating machines (coupled to 50 horsepower motors), is electrically operated. The exhaust from the propelling engines is taken through an exhaust heat boiler supplying steam for certain auxiliary purposes.

The propelling plant is of standard Burmeister and Wain type, but built under license by Kincaids. There are two engines, each developing 2,100 brake horsepower at 115 revolutions per minute and having eight cylinders, 630 millimeters bore, with a piston stroke of 1,300 millimeters. These are stock engines, and do not call for any comment, but it may be remarked that the total fuel consumption for main and auxiliary purposes works out at about 20 tons per day or slightly over.



The new Furness, Withy 13-knot cargo liner Pacific Reliance

Large bunker capacity is again a feature of this vessel, for it is capable of carrying nearly 1,500 tons of oil in double bottom tanks and two deep tanks. The radius of action is about 25,000 sea miles.

The *Pacific Reliance* has accommodations for 12 passengers, and there is a smoke room, a social room and a dining saloon for their use. Four of the cabins have a single berth and the remainder are of the two berth type.

THE BUREAU OF NAVIGATION, Department of Commerce, reports 86 steam, motor, sail and unrigged vessels of 31,510 gross tons built in the United States and officially numbered during the month of September, 1927. This includes 14 rigged vessels of 14,091 gross tons and 10 unrigged vessels of 2,734 gross tons, a total of 24 vessels of 16,825 gross tons, built in years previous to 1927.

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Questions and Answers for Operating Engineers

Practical information for marine engineers on the operation and maintenance of boilers, engines and auxiliaries

This department is maintained to help those who desire practical information regarding engine room problems or who are preparing to take examinations for a marine engineer's license. Readers are urged to send in questions. Inquiries bearing the name and address of the writer will be answered promptly by mail. If the question is of general interest the answer will also be published in an early issue of the magazine, although the identity of the writer will not be disclosed in doing so. Anonymous communications will not be considered.

Types of Turbines

Q.—What are the principal types of turbines used in marine service?

A.—Turbines are constructed on the impulse and the reaction principles and also on combinations of the two types.

Gage and Absolute Pressures

Q.—Describe the difference between gage pressure and absolute pressure?

A.—Gage pressure is pressure above atmospheric, while absolute pressure is gage pressure plus 14.7 pounds per square inch atmospheric pressure. The gages fitted and used on boilers register pressure above the atmospheric; for example, if the steam gage reads 180 pounds, the absolute pressure is 180 + 14.7 = 194.7 pounds.

Power for Steering Ahead and Astern

Q.—Is more horsepower required to put a rudder hard over, in a given time, when a vessel is going full speed ahead than when going full speed astern?

A.—More horsepower is required to put the rudder hard over when the ship is going full speed ahead, as the rudder has to be forced against the water through which the ship is going, and also against the force of the water from the propeller. When going astern less power is required, because the ship is forcing the rudder against the water, and also the suction created by the propeller helps to bring it over.

What Holds a Rudder in Hard Over Position?

Q.—When the ship is going full speed ahead and the helm is put hard over, what prevents the rudder from coming back to amidship position?

A.—The steam in the cylinders of the steering engine, and the locking effect of the barrel wheel against the worm, also friction.

Impulse and Reaction Turbines

Q.—Explain the difference between an impulse and reaction turbine.

A.—In the impulse turbine, steam is discharged from expanding nozzles against blades of the rotor, the expansion in the nozzles changing its thermal energy or power into kinetic or impulse energy. Each rotor or wheel is in a separate compartment or "stage," in which the steam pressure is constant. In the reaction type, the rotor is in a single compartment or casing and there are successive rows of blades on the rotor and casing alternately. The steam expands uniformly as it passes axially through the casing from the supply, at one end, to the exhaust at the other.

Double or Triple Ported Valves

Q.—Why are some large valves made double or triple ported?

A.—A double ported valve has only to travel one-half the distance of a single ported valve to give the same port opening, while a triple ported valve has to travel only one-third the distance.

Effect of Cut-Off on H. P. Cylinder

Q.—What effect will running in on the high pressure cut-off have?

A.—It will cause a shorter valve travel and less steam will be admitted to the cylinder. There will then be less steam for all the cylinders, which will decrease the total horsepower of the engine.

Effect of Cut-Off on I. P. Cylinder

Q.—If you run in on the intermediate pressure cut-off, what effect will it have?

A.—The power in the intermediate cylinder will be increased (just the opposite effect from that of the high pressure). It will decrease the effective pressure in the high pressure cylinder by causing a higher back pressure for the exhaust of the high pressure.

Effect of Cut-Off on L. P. Cylinder

Q.—What effect will be obtained if the low pressure cut-off is run in?

A.—The power in the low pressure will be increased. The power in the high pressure will be unaltered and the intermediate pressure power decreased, leaving the total power of engine unaltered.

Piston Rings

Q.—What are piston rings made of and why?

A.—They are made of a hard close grained quality of cast iron. Cast iron makes a better bearing surface than do most metals, with considerable less friction.

Propeller Shafts

Q.—Give the names of the different sections of shafting that are used to transmit the power from the engine to the propeller; also the different bearings.

A.—Crank shaft, thrust shaft, line shaft and tail shaft. The different bearings are crank shaft bearings, thrust bearings, spring bearings, stern tube bearings and strut bearings.

Counterbore of Cylinders

Q.—Give two reasons why a counterbore is put in the top and bottom of cylinders?

A.—The counterbore is slightly larger than the ordinary bore of a cylinder so that as the piston ring rides part way over this bore it prevents a shoulder from being worn

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at either the top or the bottom of the cylinder at the end of the stroke. The counterbore is also used in lining up the engine, or for lining up the boring bar for boring out the cylinder, as there is no wear on this bore and all measurements must be taken from it rather than from the cylinder bore proper.

Diameter of Line Shaft

Q.—Why is the line shaft generally a little less in diameter than the crank shaft?

A.—Because it is free from the bending stresses brought on the crank shaft, and has only to transmit the torsional stresses necessary to revolve the propeller and overcome friction, therefore it is generally a little less in diameter.

First Step in Setting a Valve

Q.—What is the first step you would take in setting a valve?

A.—Place the engine on the dead center.

Position of Eccentric

Q.—How is the eccentric set in regard to the crank for an outside valve and how for an inside valve?

A.—Ninety degrees ahead of the crank in the direction the engine runs plus the angle of advance for a direct valve, and 90 degrees back of the crank, minus the angle of advance for an indirect valve.

Angle of Advance

Q.—What is the meaning of the angle of advance?

A.—It is the distance that the eccentric is set past what it would be if the valve had no lap or lead. If the valve had no lap or lead the eccentric would be set 90 degrees ahead of the crank for an outside valve and 90 degrees behind for an inside valve.

Elastic Limit of Boiler Plate

Q.—What is meant by elastic limit of boiler plate?

A.—The elastic limit is the critical condition beyond which the test specimen cut and machined from the plate in question cannot be strained without a permanent distortion or set; i.e., it will not be able to return to its original form upon removal of the stress.

Ultimate Strength of Boiler Plate

Q.—What is the ultimate strength of boiler plate?

A.—The ultimate strength of a boiler plate is the highest unit stress that a test specimen cut and machined from the plate can sustain before rupturing. It equals the maximum load divided by the original area.

Elongation of Boiler Plate

Q.—What is meant by the elongation of boiler plate?

A.—The elongation is the total relative strain or the amount that the test specimen stretches before rupture. It is usually expressed as a percentage of the original length of the test piece.

Refined Cast Iron

Q.—What is refined cast iron?

A.—Refined cast iron is cast iron which has had most of its silicon removed in the refinery furnace, but still contains so much carbon as to be distinctly cast iron. The iron is made in what is known as an air furnace, which consists of a horizontal chamber, having its firing space at one end and the stack at the other. Excess air is reduced to a minimum in order to get maximum temperature of combustion. The charge is melted more by radiation from incandescent walls and roof rather than by direct contact of the flame. The slag is skimmed off as soon as the metal is all melted, which gives the metal a chance to "refine" or become oxidized to a certain extent. This process raises the temperature and reduces the silicon and carbon.

Reduction of Area of Boiler Plate

Q.—What is meant by the reduction of area of boiler plate?

A.—After fracture of the test specimen, the area at the point of fracture is measured and the reduction in area is expressed as a percentage of the original area.

Ratio of Grate Area to Stack Area

Q.—What is the ratio of stack area to grate area in marine boilers?

A.—For Scotch marine boilers the ratio of grate surface to smoke pipe area in merchant service is approximately 5 to 1.

Fundamental Laws Governing Gases

Q.—Upon what basis are all gases reckoned?

A.—All gases are referred to a common basis of 32 degrees F. and atmospheric pressure.

The characteristic equation for a gas is $PV = RT$ in which

P = absolute pressure in pounds per square foot.

V = volume in cubic feet.

R = a constant depending upon the molecular weight of the gas $= \frac{1,544}{m}$

T = absolute temperature of the gas in question.

m = molecular weight.

The difference in the specific heats $= C_P - C_V = 1.986/m$ when C_P and C_V are the specific heats at constant pressure and constant volume respectively.

The above laws form the fundamental basis in solving all problems in which gases are involved.

Homogeneous Steel

Q.—What is homogeneous steel and why is it especially adaptable for use in boiler plate?

A.—Homogeneous steel refers to the degree of freedom from segregation. During the cooling process there is danger of collecting more impurities in one part of the ingot than in another, causing at these points sources of weakness and brittleness. This uneven distribution of impurities is known as segregation. Oxidization, excessive amount of impurities, the pouring of steel when very hot, all act to increase segregation. The center of an ingot is not always homogeneous, but this irregularity is lessened in the subsequent working of the steel, particularly if it is heated for a long time, as is the case with large ingots, and also if it undergoes two different heatings and coolings, as is the case with ingots rolled into slabs or blooms, and then reheated to be rolled into plates or angles. During each heating and rolling there is a tendency toward redistribution and equalization throughout the steel.

A great deal of the corrosion in boilers is caused by electrolytic action. In a boiler the electro positive and electro negative substances exist due to non homogeneity of the metal. This non homogeneity causes a difference of potential between different parts of the metal similar to the difference of potential between the poles of a cell. If acid, salt or similar impurities are in the water from which acids or current-carrying electrolytes are derived we have a galvanic cell formed and current flows, with the result that the electro positive substance is eaten away or corroded. It, therefore, follows that the more homogeneous the plate the less will be this electrolytic action.

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Questions and Answers Relating to Naval Architecture and Marine Engineering

Conducted by James L. Bates, Naval Architect, and W. B. Newton, Marine Engineer

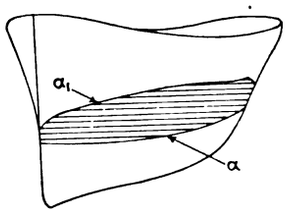
This department is maintained for the purpose of answering all questions relating to ships and their machinery. All inquiries should bear the name and address of the writer. Anonymous communications will not be considered. The identity of the writer, however, will not be disclosed unless the editor is given permission to do so.

Water Lines and Water Planes

Q.—What is the difference between water lines and water planes?

A.—A plane may be defined generally as a surface, real or imaginary, such that a straight line connecting any two points in the plane will itself lie wholly in the plane.

If now a horizontal plane be passed through the hull of the ship, that portion of the plane enclosed by the ship's shell plating or envelope will be a water plane. If it happens that this plane coincides with the surface of the water in which the ship floats it will also be her plane of flotation. Then, the line formed by the intersection of the water plane of the ship with the molded surface of her hull (for our purposes her shell plating) is her water line. In the figure, the shaded portion represents the "water plane" and the lines a and a_1 are water lines.



Sketch showing water plane and water line

Horsepower of Lake Freighter

Q.—What horsepower is required to drive a ship of the following dimensions 12 and 12½ miles per hour: Keel length, 596 feet; breadth, 64 feet; draft, 19 feet; block co-efficient, 0.86? The vessel is to be propelled by a triple expansion engine. The steam pressure is 185 pounds per square inch.

A.—The dimensions of the ship which you contemplate are very similar to those of two ships for which model basin tests are available. I have corrected these data for the small differences which exist and taken the average of the resulting effective horsepowers.

I have assumed that the ship in question will not have bilge keels and that the effect of the rudder and stern frame upon resistance is allowed for in the value of the propulsive coefficient adopted.

I have assumed that the ratio of the effective to the shaft horsepower is 65 percent and that the shaft horsepower is 92 percent of the indicated. This gives an over all value of the propulsive coefficient, based upon bare hull effective horsepower to indicated horsepower, of nearly 60 percent. This is in general agreement with the published opinions of leading authorities.

The following results from this consideration of the problem:

Speed in statute miles of 5,280 feet.....	12	12½
Effective horsepowers, bare hull	1,450	1,660
Value of propulsive coefficient	0.60	0.60
Estimated values of indicated horsepower..	2,420	2,770

In order to make the above estimates, the following assumptions were necessary.

The "keel length" to which you refer is the length between stem and propeller post.

The shape of midship section conforms generally to Great Lakes practice. A dead rise of 3 inches, a bilge radius of 36 inches and a vertical side from bilge to water line have been assumed. This gives a value of mid section coefficient of about 99 percent.

Parallel middle body extends for about 40 to 50 percent of the vessel's length and is properly disposed about the middle perpendicular to insure reasonable resistance and a good flow of water to the propeller.

I have checked the figures quoted above by the method of estimate described by E. M. Bragg in Sterling's Marine Engineers' Handbook. The data there furnished are based upon a series of experiments in the model tank at the University of Michigan.

In case the speeds quoted are intended to be realized under average service conditions, it is suggested that the machinery should be designed to develop a good margin of power. Professor H. C. Sadler stated that over a year's operation the average sea speed might be expected to fall below the trial speed by from about 8 to 10 percent (see *Transactions* of the Society of Naval Architects and Marine Engineers, 1919). In order to meet this standard it would be necessary to design the machinery for 3,250 and 3,750 indicated horsepower depending upon whether 12 or 12½ miles service speed were desired.

Advantage of Superheat

Q.—If a boiler were too small for the engine, what, if any, would be the advantage of a superheater and why?

A.—The addition of superheaters to the boiler would raise the total heat contained in each pound of steam. Therefore, with the same number of pounds of steam generated per hour as without superheaters a proportionate increase in heat units delivered to the engine per hour would result. Now as the number of heat units contained in one horsepower is constant it follows that less steam would be required to produce that horsepower. It then follows that for the same engine horsepower the addition of superheaters permits of a reduction in boiler generating surface.

Expansion in Steam Pipes

Q.—In what four ways is the allowance made for expansion in steam pipes (in a marine plant)?

A.—Expansion in steam pipes in marine service is compensated by the use of bends and loops, slip joints, accordion type joints and diaphragms. The loop is simply a pipe bent into nearly a complete circle. The slip joint consists of a cylindrical casting bolted to the end of the pipe and a sleeve bolted to the next section of pipe in the line and free to slide in the cylindrical casting. The joint being made steam tight by a stuffing box and gland.

The accordion type consists of a circumferentially corrugated piece of pipe inserted between two sections of the pipe line.

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The diaphragm type is made up of two circular plates of larger diameter than the pipe, fastened together at the circumference with an inserted ring separating them. The flanges of the pipe sections are fastened to the plates at their center.

Brake vs. Indicated Horsepower

Q.—If a Diesel engine has 1,500 brake horsepower and a mechanical efficiency of 75 percent, what is the indicated horsepower?

A.—An engine having a brake horsepower output of 1,500 and 75 percent mechanical efficiency would have an indicated horsepower of 1,500/0.75 = 2,000.

Pointers

Q.—What are "pointers"?

A.—Recently Mr. Frank N. Bruning, of Brooklyn, N. Y., inquired through this department as to the meaning of the term "pointers." Having failed to secure the information from us, he now furnishes the following as the result of his own further research:

"The term 'pointers' is a term used in wooden ship construction. Wood ships can have from one to three pointers. They are located on top of the ceiling in the fore and aft ends of the vessel to strengthen those parts against torsional and panting stresses. They are in the form of a curved V made in halves and connected together with a crutch at their heels or lower ends. They generally extend diagonally from the ceiling to the first deck."

Testing Uneven Crosshead Pin Bearing Wear

Q.—Can you give me some method or methods that I can use in telling whether a connecting rod of a marine engine with the ordinary divided crosshead pin brasses is hanging straight up and down, that is, if one brass is worn more than the other? I notice in some engines after adjusting the crank pin brass, when a bar is inserted between the web and brass to find out if it has been set up too tight, the connecting rod seems to have a spring in it, it seems to spring back when you let go the bar. Is this a sign that the connecting rod is out of line? Also can you recommend some book devoted exclusively to the adjusting and lining up of engines?

A.—Put the crank at the top dead center and block the crosshead in this position. Remove the top crosshead bearing caps and drop the crank to the bottom dead center. With the connecting rod held in a vertical position measure the distance from the inside of the bottom bearing to the under side of the crosshead pin. If the measurements for both pins are alike, the bottom brasses are wearing evenly.

Put the crank on the top dead center and block the crosshead in this position. Remove the bottom crank pin brass, turn the crank to the bottom dead center and measure the distance at each end of the crank pin from its top side to the under side of the top brass bearing. If these measurements are the same, then the top crosshead pin brasses are wearing evenly.

Remove the crank pin brasses, put the crank on the top dead center and with the rod lowered to the crank pin measure the distance on either side of the rod butt end to the crank web. Now with the crank on its lower dead center and the rod lowered to its bottom position, take similar measurements. If the top and bottom measurements are equal, the rod with its piston rod is in line.

I do not consider the spring back of the connecting rod on removal of the bar an indication of misalinement. It might be due to less fore and aft clearance at the crosshead end than at the crank end. The crosshead end bringing up on the block and the lower end being free to move still further would cause the rod to spring. However, if the bar be inserted first on one side of the brass and then on the other, using about the same pressure each time, and the spring back appears to be about the same amount, the probability is that the rod is properly lined up.

I know of no book devoted to adjusting and lining up of engines. Practically nothing, to my knowledge, has been written on this important subject.

LETTER TO THE EDITORS

Power Transmission

STONEHURST, Delaware County, Pa.

TO THE EDITORS:

The writer has read with interest and appreciation your article entitled "Power Transmission," on page 540 of the October, 1927, number. Such reviews are valuable in that they assist in stimulating the thoughts of our engineers and operators toward further advancement in the art.

With detailed reference to the article mentioned, it is thought appropriate to amplify and offer qualifications to part of the subject matter contained therein. It is expected, of course, that this statement will be accepted in the spirit in which it is offered.

Paragraph four states that, "The first geared turbine vessel, the *Vespasian,* came out in 1910, and here may be said to have commenced, as a distinct and modern problem, marine power transmission as affected and modified by the type of engine or prime mover employed."

Actually, Sir Charles Parsons had experimented with a 10 horsepower geared turbine drive in a yacht tender in 1890. He was not especially converted to geared transmission as a result of his test, or by the De Laval success with gears up to 300 horsepower.

In 1904, Rear Admiral George W. Melville, U. S. N. (Ret.), and John A. Macalpine published a not very encouraging report as to the status of the steam turbine when applied to the propulsion of ships, which they had made up for George Westinghouse. The conclusion of that report read as follows:

"If one could devise a means of reconciling, in a practical manner, the necessary high speed of revolution of the turbine with the comparatively low rate of revolution required by an efficient propeller, the problem would be solved, and the turbine would practically wipe out the reciprocating engine for the propulsion of ships. The solution of this problem would be a stroke of great genius."

On January 15, 1909, Sir Charles Parsons, in concluding his James Watt Anniversary lecture at Greenock, Scotland, stated as follows:

"We might naturally speculate as to the future, and inquire if there is a possibility of the turbine being constructed to run more slowly, and without loss of economy, or whether the propeller can be modified to allow of higher speeds of revolution. Or, again, may the solution be found in reverting to some description of gearing—not the primitive wooden spur gearing of half a century ago, but to steel gearing cut by modern machinery with extreme accuracy and running in an oil bath, helical tooth gearing or chain gearing, or again, some form of electrical or hydraulic gearing? These are questions which are receiving attention in some quarters at the present time, and if a satisfactory solution can be found, then the field of the turbine at sea will be further extended."

Mr. James Denny, of Dumbarton, Scotland, in his Presidential Address to the Institute of Marine Engineers in Britain on October 5, 1908, said:

"It has frequently been suggested that if some inspired engineer would evolve a system of gearing that would be lasting and reliable, not too noisy, and would not absorb in friction more than, say, 10 percent of the power, turbine engines would be capable of application to any speed of vessel, and to any size of propeller, you would then have a high speed turbine and a low speed propeller, which is the ideal condition for marine propulsion."

In 1909, George Westinghouse published "Broadening the Field of the Marine Steam Turbine," in which he announced the solution of the problem by means of the gear that Messrs. Macalpine and Melville had themselves invented. His publication further gave the results of tests

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conducted at East Pittsburgh with a 6,000 shaft horsepower turbine, gear and water brake.

The foregoing synopsis indicates most strongly that the problem referred to commenced previous to 1910, and had been well studied before that time.

Paragraph eight, quoted in part, states "——and since then, with the exception of destroyers, but few of our naval vessels have been fitted with mechanical gearing, while a considerable number, having an enormous total horsepower in their propelling machinery, have been equipped with turbo-electric drive—— ."

Since 1912, the Navy has installed geared turbines in ten 7,500-ton scout cruisers of 96,000 shaft horsepower each, one battleship of 28,000 shaft horsepower, in the U. S. S. *Pyro, Nitro, Relief, Melville,* and is now building eight 10,000-ton scout cruisers of 116,000 shaft horsepower each. In addition, since that date, geared cruising turbines have been installed in the battleships *Idaho, Pennsylvania, Arizona, Mississippi, Texas, Florida, Arkansas, Wyoming* and *Nevada.* Geared turbines have also been installed, since 1912, in sixty 500-ton, 2,500 shaft horsepower Eagle boats, three 110-foot submarine chasers, and in the U.S.S. *Topeka,* as well as in fifteen transports of 108,000 shaft horsepower total.

Paragraph nine, quoted in part, states, "—furthermore, the possibility of using a portion of the main propelling plant to operate auxiliaries, both at sea and in port, as can very easily be done with a Diesel-electric combination, does not exist with the steam-electric drive."

The writer wishes to point out that it not only exists with the steam-electric drive, but that it is being done on two large Great Lake bulk freighters, S.S. *Carl D. Bradley* and *Samuel D. Robinson,* which have alternating current steam-electric propulsion, and it is further being done on the two Key Route ferry boats *Peralta* and *Buena Yerba,* which have geared direct current steam-electric propulsion.

Paragraph fourteen, quoted in part, states: "These new vessels will be built in Great Britain and are the largest Diesel electric ships which have yet been ordered."

The Standard Oil Company of California is converting the ex-Shipping Board tanker *District of Columbia,* to Diesel-electric drive, with complete electric auxiliaries. The ship will be propelled by a 3,200 shaft horsepower motor.

CARL J. LAMB.

Abstracts of Articles Translated from the Foreign Press

Heating Systems in Ships

High pressure steam heating in ships is not desirable from the point of view of hygiene. It has, however, the advantage of light weight and small cost of installation as compared with the normal pressure steam heating and warm water heating systems. The high pressure system is the most economical when used for shorter periods of time only but for steady use the warm water heating system becomes more economical, although the cost of installation of the latter is high. Air heating can be adopted only where no great amount of heat is required; the cost of installation is lower than with the high pressure steam system, while the operating cost is much higher.

On first class passenger steamers where the warm water heating system is used the weight of the installation can be reduced to nearly the same as that of the steam heating installation.

Normal pressure steam heating is the most economical on motorships when comparatively small spaces in the same location are to be heated. Electric heating is economical only when heat is required occasionally for a few rooms, the electric heaters being supplied by current through the lighting system.—*Werft Reiderei Hafen,* August 7, 1927. 2½ pages.

Turbine Ferry Boat Seikan Maru No. 1

This vessel, recently constructed by Yokohama Dock Company for the Japanese State Railways, maintains the service between Hakodate and Aomori a distance of about 60 miles. Her dimensions are: length, 366 feet; beam, 52 feet; draft, 11.5 feet; speed, 13.5 knots. There are 4 railway tracks on the main deck and a total of 43 carriages each weighing 15 tons can be accommodated.

The main machinery consists of two Brown Boveri turbines with double reduction gearing each developing 1,100 shaft horsepower. The ahead and astern turbines are cast in the same cylinder. The ahead turbine is of the combined impulse and reaction type while the astern turbine is of the impulse type.

Steam is furnished by two boilers with superheaters at a temperature of 250 degrees C. The speed of the turbines is 5,060 revolutions per minute which is reduced to 135 revolutions per minute at the shaft. The steam consumption during trials was approximately 11 pounds per shaft horsepower.

The weight of the turbines is very small, the total weight of both turbines with reduction gearing being less than 36 tons or about 34.5 pounds per shaft horsepower.—*Bulletin Technique du Bureau Veritas,* September, 1927. 1 page. 1 diagram.

Model Experiment and Trial Trip Data

In this article the lines are shown of a Diesel-engined cargo vessel of 5,800 tons displacement, 360 feet by 50.5 feet by 17.56 feet draft. A model of the vessel was towed in the Teddington tank and a modification of the lines in the fore and after body, as suggested by the model experiments, is shown dotted.

Interesting "speed and power" curves of this vessel, for speeds up to 17 knots obtained from the model tank and from Taylor's series, show very close agreement. Similar sets of curves are given for the following Diesel-engined cargo vessels:

1. 304 feet by 45.5 feet by 21.16 feet draft by 6,600 tons displacement.
2. 307.6 feet by 45.5 feet by 21.16 feet draft by 7,180 tons displacement.
3. 380.25 feet by 55 feet by 24.33 feet draft by 11,180 tons displacement.
4. 405 feet by 55 feet by 27.33 feet draft by 13,250 tons displacement.

These curves, plotted from actual trial trips and Taylor's series show close agreements.—*Tehnish Tedsskrefl,* September 17, 1927. 4 pages. 6 diagrams.

Motorship Beethoven

The motorship *Beethoven* is a new Diesel passenger steamer for the Rhine service, carrying 600 passengers. The principal dimensions are: Length, 155.54 feet; beam, 22.3 feet; depth, 7.38 feet; draft, 3.58 feet. The vessel is driven by twin screws, one 235 horsepower, six cylinder, four stroke Deutz engine driving each propeller. The engines, which are the solid injection type, are direct reversible, the maneuvering is faster than with the steam engine. The trial trip speed was about 10¼ miles per hour, the total horsepower 520, the revolutions of the engines 258 and the oil consumption 0.36 pound per horsepower hour.

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PERSONAL MENTION

SIR ALFRED YARROW, for many years prominent in shipbuilding and marine engineering, has retired from the presidency of Yarrow and Company, Ltd., Glasgow, Scotland.

CHARLES E. MCCARTHY has been transferred from the United States Lines, New York, to the position of assistant manager of the stevedoring division of the Merchant Fleet Corporation at Washington, D. C.

C. A. ARNOLD has been appointed to the salaried secretaryship of the new Gulf Conference, with headquarters at Gulfport, Miss. N. M. Leach of New Orleans is chairman of the conference at the Gulfport end.

TYSON KINSELL of Portland, Ore., who has been assistant to Commissioner Myers of the United States Shipping Board since the appointment of the latter, has resigned to resume the practice of law in his home city.

CAPTAIN S. C. FENN, formerly operating manager and marine superintendent for the Tampa Interocean Steamship Company, New Orleans, La., has been appointed port captain at Galveston, Texas, for the United States Shipping Board.

DR. ALFRED E. BURTON, professor emeritus of topographical engineering of the Massachusetts Institute of Technology, will assume direction on December 1 of the American Merchant Marine Library Association. The association serves nearly 2,000 merchant vessels and 100 life-saving stations of the United States Coast Guard.

SIR GEORGE BURTON HUNTER will retire from the chairmanship of Swan Hunter and Wigham Richardson, Ltd., the well known shipbuilders at Wallsend, England, after the shareholders' annual meeting in 1928. He will be succeeded by T. E. Thirlaway, vice chairman of the company. Sir George will not retire from the board of directors.

B. Y. MARTIN, former assistant manager of the agreements and adjustments division of the Merchant Fleet Corporation at Washington, D. C., has been appointed district traffic manager at Baltimore, Md., in place of J. G. Tompkins, who has been transferred to Washington as manager of the European and Mediterranean trades division.

COLONEL F. C. BOGGS, United States engineer in charge of Pennsylvania and New Jersey, has been appointed governor of the Panama Canal Zone and president of the Panama Railroad and Steamship Company, New York. Colonel Boggs will assume his new duties January 1, 1928. Colonel Willdeus has been appointed to succeed Colonel Boggs as United States District Engineer.

NEIL S. LAIDLAW, formerly district manager for the Garland Steamship Corporation, 25 Broadway, New York, has been appointed district freight agent for the Calmar Line at Los Angeles, Cal. J. C. Reed, formerly of the Williams Line, New York, has been appointed contracting freight agent for the Calmar Line, as well as H. E. Fry, also formerly of the Williams Line.

FRANK J. O'CONNOR, manager of the Donovan Lumber Company, San Francisco, Cal., has been appointed president of the Ship Owners' Association of the Pacific Coast, and Ralph W. Myers, of San Francisco, has been reelected first vice president. James H. MacLafferty, now head of the Washington bureau of the two Pacific coast steamship associations, also has been elected a vice president of the association.

JAMES A. WILSON, former director of operations of the Merchant Fleet Corporation and lately especial assistant to Brigadier General Dalton, president of the corporation, has resigned to become first vice president of the Texas Oceanic Steamship Company, operating the Texas Ukay Line for the United States Shipping Board between Texas and ports in the United Kingdom. Mr. Wilson will make his headquarters at either Galveston or Houston, Texas.

OBITUARY

DAVID W. SIMPSON, well known shipping broker and steamship operator of Boston and formerly owner and operator of the Simpson Dry Dock in East Boston, Mass., died at his home in East Boston on Saturday, October 8. Mr. Simpson was 66 years of age.

WARREN T. BERRY, for 14 years superintendent of marine construction of the New England Steamship Company, with headquarters at Newport, R. I., died on October 1, at Boston, Mass., at the age of 55 years. Mr. Berry commenced his experience in marine engineering and shipbuilding as an apprentice at the W. & A. Fletcher works at Hoboken, N. J. After leaving Fletcher's he became superintendent of floating equipment of the New York, New Haven and Hartford railroad at Harlem River and later was employed in an executive capacity by the Quintard Iron Works of New York. Both at Fletcher's and at the Quintard Iron Works he was intimately connected with the construction of many of the vessels for the New England Steamship Company which, in later years, he was called upon to run. No man in the marine engineering profession was more respected for his professional attainments and knowledge or better liked because of high personal character and friendliness. His passing leaves a void comparable, particularly among the younger members of the profession, with that left by his eminent uncle, the late Stevenson Taylor.

Warren T. Berry

HARRY R. BARRIE, vice president and general manager of the Detroit-Port Huron Steamship Company, Detroit, Mich., died suddenly at his home in Detroit, October 10. Mr. Barrie, who was active for many years in lake transportation circles, was general manager of the Detroit-Port Huron Line since its origin in 1925. He was 45 years of age.

MARVIN W. NEELAND, president of the New York Shipbuilding Corporation during and after the World War until his retirement from business in 1925, died suddenly on Sunday, October 23, of heart disease at his home, 815 North Roxbury Drive, Beverly Hills, Cal. For many years before he became a shipbuilder, Mr. Neeland had been a vice-president of the United States Steel Corporation, having supervision of its engineering problems.

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The Month's Shipping and Shipbuilding News in Brief

Shipyard, Steamship and Port Activities and Other Notes of Interest in All Branches of the Marine Industries

Model Tests Conducted on Proposed Fast Atlantic Liners—Backers of Plan to Meet with Shipping Board on November 21

SUCCESSFUL tests were conducted on Monday, October 17, in the experimental model basin of the Washington Navy Yard with a 20-foot model of the proposed new transatlantic liners that will cut the voyage across the Atlantic to four days. If built the ships are to be equipped so that airplanes can land on their decks and it is hoped in this way they will make mail delivery possible across the ocean in three days.

The model proved its ability to make 35 knots in wave conditions simulating a severe North Atlantic storm. The tests were conducted in the presence of Chairman T. V. O'Connor and Commissioners Hill and Teller of the United States Shipping Board and Vice-Presidents Dalton, Jenkins and Kelley of the Merchant Fleet Corporation. A formal hearing before the board has been requested by the American Brown Boveri Electric Company, which is sponsoring the project, for Monday, November 21. Request will be made then for a loan from the construction fund of the board.

The proposed company is to be incorporated as the New York-London-Paris Steamship Company (Blue Ribbon Line) to operate a fleet of ten 20,000-ton liners. If the contemplated plan is financed the ships will be constructed in American shipyards. They are to have a speed of 32½ knots and make the trip to England in 96 hours and to France in 101 hours. The liners will be approximately 800 feet long, 80 feet beam and 24 feet 9 inches draft.

New York City Ferryboat Plans to Be Submitted to Board of Estimate for Approval

THE latest word from the New York City Department of Plant and Structures of which A. Goldman is Commissioner, concerning the proposed ferryboat of the *American Legion* type, is that two plans have been prepared by R. W. Morrell, naval architect for the Department which are to be submitted to the Board of Estimate.

If the original plans are approved by the Board it is likely that the specifications will be issued within a short time. Should the alternative plans be chosen however, numerous hull changes will be required which will take somewhat longer to put in shape before they are submitted to the shipyards for proposals.

In either case the new ferryboat will closely follow the previous design as incorporated in the *American Legion*, the principal characteristics of which are as follows:

Length overall	264 feet
Breadth over guards	66 feet
Depth of hull at guard	19 feet 4 inches
Draft in operating condition	12 feet 6 inches

Bids Being Asked for Construction of Steamer for the New England Steamship Company

IT is understood that bids have been received from shipyards along the Atlantic coast by the New England Steamship Company, Newport, R. I., for the construction of a steamer which is to follow the same general lines as the steamer *Nobska*, the last vessel added to the fleet.

The *Nobska* was built in 1925 by the Bath Iron Works, Ltd., Bath, Maine, and was delivered in April of that year. This boat was designed under the supervision of the late Warren T. Berry, superintendent of marine construction. Details of the *Nobska* as indicated below will serve to give a comprehensive idea of the requirements to be met in the new steamer.

The length overall is 210 feet; length between perpendiculars 202 feet, breadth, molded, 36 feet; depth, molded, 14 feet 6 inches; maximum draft 10 feet; gross tonnage 1,082 and passenger capacity 2,000.

The propelling machinery consists of a four cylinder, triple expansion engine, 16 inches, 26 inches, 30 inches and 30 inches by 24 inches stroke and two Babcock and Wilcox boilers, burning coal.

The new vessel will be constructed almost entirely of steel and is to be practically fireproof, but will, nevertheless, be equipped throughout with automatic sprinklers and have a complete thermostatic fire alarm system. The ship is to be designed throughout for the safety and comfort of its passengers.

Dravo Contracting Company to Build Floating Hoist

THE Dravo Contracting Company, Pittsburgh, Pa., has been awarded a contract by the United States Engineer Office, Louisville, Ky., for furnishing all labor and materials and constructing and delivering one floating A-frame hoist, bids for which were received at Louisville on September 19. The Dravo Contracting Company was low bidder with a price of $29,800.

Shipping Board Awards Contracts for Converting Three Freighters to Diesel Electric Drive

THE Shipping Board at its meeting Thursday, October 13, directed that contracts for converting the steel-cargo steamships, *Courageous*, *Defiance* and *Triumph* to Diesel-electric motor ships be awarded the Federal Shipbuilding Company, Kearney, N. J., the Norfolk Navy Yard and the Boston Navy Yard, respectively. By means of the conversion the speed of these vessels will be advanced from approximately 10 knots, of which they are capable in their present condition, to an estimated speed of between 13 and 14 knots.

The amounts of the contracts are as follows: *Courageous*, $1,319,000;; *Defiance*, $1,192,000; and *Triumph* $1,315,000. These figures are about 60 per cent of the estimated cost of constructing new vessels of this type in American shipyards and are less than the cost of constructing similar high-speed freight ships in foreign shipyards. Thus by the conversion of these vessels, three new motorships, suitable for competition with the new motorships built for foreign flag operation, will be provided for the American merchant marine. Work will be commenced as soon as practicable.

The vessels will be equipped with McIntosh and Seymour Diesel engines, the cost of which is included in the contract prices. The prices given also include certain modifications of the ships' hull lines in order to aid in increasing the speed of the vessels. As converted the ships will be of 10,500 deadweight tons each, and each will have 600,000 cubic feet of cargo space.

The plans for converting these vessels have been perfected under the direction of William Francis Gibbs, naval architect of New York, and Rear Admiral D. W. Taylor, U. S. N., (retired). Mr. Gibbs and Admiral Taylor have also re-designed the hull lines of these ships, receiving the cooperation of the Navy Department in making experimental tests of models.

Diesel Tugboat Inquiries on West Coast

JOHN A. YOUNG, general manager of Young Brothers, Ltd., of Honolulu, for whom the Diesel-powered tug *Mahoe* was built two years ago at the plant of the Ballard Marine Railway Company, Inc., Seattle, Wash., is in Seattle in connection with the construction of another tug for his firm.

The *Mahoe* is equipped with twin Fairbanks-Morse Diesel engines. The vessel was designed by L. H. Coolidge, Seattle naval architect. She is used to tow pineapple barges from outlying ponits in Hawaii to Honolulu.

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Ferryboat Company Formed at Chester—Two Modern Ferryboats Will Be Built

ACCORDING to an announcement issued by officials of the Chester and New Jersey Ferry Company, Chester, Pa., a ferry line connecting Chester with Bridgeport on the New Jersey side of the Delaware river is now an assured fact, and work on the project will be soon started.

Two modern ferryboats will operate on an eight-minute schedule across the Delaware river, which is slightly less than a mile wide at that point. The project will cost nearly $400,000. Edward T. Bartlett is president of the company; W. D. Gash, vice president; T. J. Sproul, treasurer, and Josiah Sleeper, secretary. It is understood that the entire line will be in operation to take care of next spring's heavy traffic.

Shipping Board Reorganization

IN order to place the business operations of the Shipping Board on a basis as nearly as possible approximating the standard commercial practice, and recognizing the necessity of placing in the hands of a single executive ample authority and control to properly conduct the affairs of the Merchant Fleet Corporation, such executive reporting to the Shipping Board as to a board of directors, the Shipping Board on Thursday, October 13, elected to make the seven members of the Shipping Board the Board of Trustees of the Merchant Fleet Corporation as the real governing body or Board of Directors.

In order to do this it was necessary under the Articles of Incorporation of the Merchant Fleet Corporation to elect the Chairman of the Shipping Board the President of the Merchant Fleet Corporation and Chairman of the Board of Directors. General A. C. Dalton, now President of the Merchant Fleet Corporation, is to be Vice President and General Manager with the same administrative powers and duties which he has heretofore exercised as President of the Corporation, responsible to the Board of Trustees (now the Shipping Board) for results in operation.

The Board also elected Messrs. E. A. Kelly and J. Caldwell Jenkins as Vice Presidents of the Merchant Fleet Corporation with the same functions and responsibilities as heretofore, under the Vice President and General Manager.

This action of the Board not only has the full approval and support of General Dalton but was passed unanimously by the Board. Chairman O'Connor said that it was his belief that this change in procedure will have the effect of facilitating the carrying on of the work which has been accomplished during the past year, which from the standpoint of administrative and operating results has been one of the most successful in the history of the Merchant Fleet Corporation.

New Bids Asked on Repairs to S.S. Anthony O'Boyle

NEW tenders are now being received by Anthony O'Boyle, 15 Moore street, New York City, covering repairs to the steamship *Anthony O'Boyle* of 2,450 gross tons, which went ashore in Robinson's Hole, on the easterly side of Vineyard Haven, on January 30, last. The lowest proposal received on the last request was $113,000.

Morse Drydock Company Awarded Contract for Reboilering Steamships City of Atlanta and City of Columbus

A CONTRACT has been awarded to the Morse Drydock and Repair Company, Brooklyn, New York, by the Ocean Steamship Company of Savannah, Savannah, Ga., for reboilering the steamships *City of Columbus* and the *City of Atlanta*. It is understood that the Morse yard has placed an order with the Federal Shipbuilding Company, Kearny, N. J., for the construction of the boilers which will be similar to those originally installed.

The vessels have a length of 377 feet 6 inches, a beam of 49 feet and a depth of 15 feet 9½ inches, with a deadweight tonnage of 5,500. They are each fitted with four Scotch boilers, carrying a working pressure of 180 pounds per square inch.

Bids Received for Turbine Drive and Diesel Drive Yachts

IT is understood that bids have been received and opened by the firm of Henry J. Gielow, Inc., 25 West 43rd street, New York, covering construction of two yachts, specifications for which were sent out to shipyards a few weeks ago. On the first of these yachts, which is a 340-foot Diesel yacht, to be equipped with three 1,500 horsepower engines, the bids vary between about $1,000,000 and $1,600,000. It is believed that these figures are too high and that further bids will be asked. In the case of the second yacht, which has a length of 240 feet, to be driven by twin screw turbines, the estimates vary between $600,000 to $1,000,000, which also are considered to be too high for the work, so that undoubtedly further proposals will be called for shortly.

State of New Jersey May Build Large Drydock

COLONEL James H. Hayes of West Orange, New Jersey, has been appointed chairman of a committee of the State Chamber of Commerce to investigate the possibility of erecting a drydock in New Jersey sufficiently large to accommodate the largest vessels. Sites at Greenville and Weehawken, on the Hudson River, and at Port Newark have been advanced as possible locations. It has been suggested to the committee that the dock be built by the state.

Repairs to S.S. Selwyn Eddy Amounted to $90,000

A CONTRACT for repairing the steamship *Selwyn Eddy*, which grounded in Tarpaulin Cove last February and was floated into drydock recently, has been awarded to the Fore River plant of the Bethlehem Shipbuilding Corporation, Ltd., Quincy, Mass., at a price of $90,000.

Lighthouse Service Receives Bids for Two Electric Drive Lightships

SEALED proposals were received by the United States Lighthouse Service, Washington, D. C., until October 15, and then opened, for the construction of two electric drive lightships, one of which will be stationed off San Francisco harbor to replace the one on duty there for the last 30 years.

Although both Pacific and Atlantic shipbuilders have been asked to bid, the Pacific Coast builders have about $20,000 in their favor on the new San Francisco lightship, because it is estimated it will cost that much to send the vessel from the East Coast to its new station off the Golden Gate.

General Details of Lighthouse Tenders

The general dimensions are: Length overall 133 feet 3 inches; length on waterline 108 feet 9 inches; beam 30 feet; depth at side, molded, 15 feet; draft 11 feet 9 inches forward, 13 feet 3 inches aft; displacement 630 tons, and shaft horsepower 350. The hull and superstructure are built entirely of steel having complete fore and aft main and upper decks with two deck houses. The forward deck house comprises the pilot house and the master's quarters; the after deck house contains the radio room and the operator's quarters.

Propelling Machinery

The propelling machinery consists of a direct connected double armature motor delivering 350 shaft horsepower to a single screw propeller.

The motor is controlled from a switchboard located below and the current is furnished by four 112 horsepower direct connected four-cylinder Diesel engine driven generators delivering direct current at 125 volts each. The steering is done by hand by means of a geared drum and wire ropes. The balance of the auxiliary machinery consists of two motor driven air compressors for fog signal, one motor driven bilge and fire pump, one motor driven donkey fuel oil pump, one reciprocating air driven fresh water pump, an electric driven refrigerating system, a 50-horsepower windlass on the main deck forward, and an electric driven boat hoist on the upper deck.

New Ship Repair Plant on West Coast

WITH a capitalization of $250,000, the Ship Repairs, Inc., has been formed at San Francisco by the Matson Navigation Company, San Francisco, Cal., and the Bethlehem Shipbuilding Corporation, Ltd., Bethlehem, Pa. The new company will specialize in minor ship repair work not requiring drydock service. L. K. Siversen, sales manager of the Bethlehem Shipbuilding Corporation, is president; George K. Nichols, manager of engineering and repairs, Matson Navigation Company, vice-president; John E. Ryan, secretary, and John T. Greany, assistant sales manager of the Bethlehem Shipbuilding Corporation, and Hugh Gallagher, assistant manager, Matson-Oceanic Line, directors.

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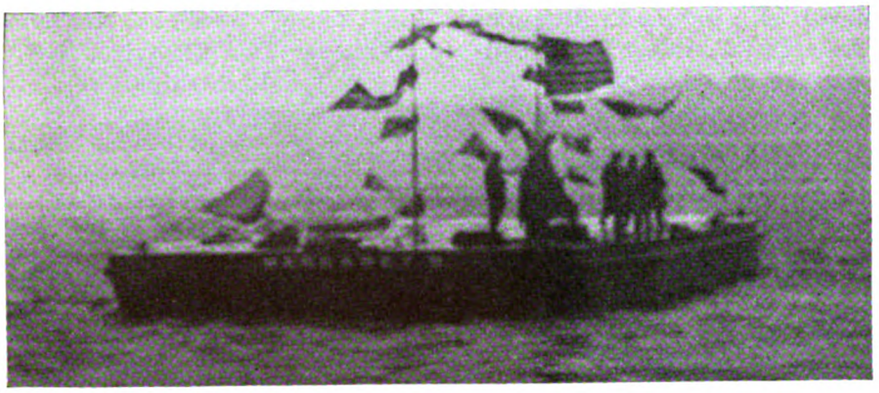

The float Margaret S. immediately after launching at Fore River plant

"Mrs. Mac" Christens Float at Fore River Plant

A LAUNCHING of general interest to the marine world occurred on September 2 at the Fore River plant of the Bethlehem Shipbuilding Corporation, Ltd., when a small float was launched with all the formalities usually reserved for vessels of a higher rating, during which the sponsor, Mrs. Margaret S. MacDonnell, chief stewardess of the Fore River plant, christened the craft the *Margaret S.* in honor of herself. This float was constructed to the personal account of the Fore River plant for its own use in the building and repairing of ships around Boston harbor.

Although this plant has built vessels of every conceivable design numbering into the hundreds, the *Margaret S.* was the first ever built to its own account. Being an event which was unique in the history of the organization, S. W. Wakeman, vice president of the Bethlehem Shipbuilding Corporation, Ltd., in charge of operations on the Atlantic coast, chose as sponsor one of the plant's own people who is well known throughout the shipbuilding, shipowning and ship operating world, being affectionately known as "Mrs. Mac." In her official position as stewardess of the Fore River plant the sponsor has extended hospitality of a truly New England character to a host of people connected with the marine field.

Although the float was a diminutive one being but a pigmy alonside the airplane carrier *Lexington* now under construction at this plant, the christening ceremony was symbolical of the esteem and affection held locally for the sponsor and which is shared by the innumerable friends of Mrs. MacDonnell who are now spread broadcast throughout the globe wherever ships or shipping are known.

Among the officials connected with the Fore River plant attending the launching with their families were:

S. W. Wakeman, vice president, Bethlehem Shipbuilding Corp., Ltd.; Captain

Mrs. Margaret S. MacDonnell, sponsor of the Margaret S.

Louis Shane, U. S. N., inspector of machinery; Captain Waldo P. Druley, C. C., U. S. N., superintending constructor; Harry E. D. Gould, general superintendent, Fore River plant; John Burkhardt, chief engineer; H. E. Bisbee, assistant to the vice president; Howard Towle, assistant to the vice president; William Binley, Jr., naval architect; Henry H. Schultze, chief estimator; R. S. Campbell, superintendent of machinery; William Collins, hull superintendent; Harry E. Parker, service manager, and T. A. Andrews, assistant to the general superintendent.

Proposals Asked for Steel Pontoons

THE United States Engineer Office, Cincinnati, Ohio, received sealed proposals until October 25, for constructing and delivering steel pontoons and riveted steel pipe. Further information may be obtained on application.

Bids Asked for Four Buoy Boats

SEALED proposals will be received at the office of the Superintendent of Lighthouses, Third District, Staten Island, New York, until November 7, for the construction of four 38-foot buoy boats, complete with four cylinder gasoline engines. Further information may be obtained on application.

Work Commenced on Second Liner for International Mercantile Marine Company

PRELIMINARY work on the second vessel of its program of three sister ships was recently started at the yards of the Newport News Shipbuilding and Drydock Company, Newport News, Va., for the International Mercantile Marine Company, New York, for its Panama Pacific Line's intercoastal service between New York and San Francisco. The vessel will be named the *Virginia*.

Like the *California* which was recently successfully launched at the Newport yard, the *Virginia* will be of 22,000 gross tons, or twice the size of the famous old American liner *St. Paul*, which for many years operated in the trans-Atlantic trade. The Panama Pacific liners will have a speed of 18 knots, which will enable them to cut two days from the present running time of 18 days.

Atlantic Works Builds Its 21st Ellis Barge for N. Y. Central

A CONTRACT for a pile driver barge to be built under the Ellis channel system of steel hull construction has been let by the New York Central Railroad to the Atlantic Works, East Boston. This barge is 58 feet by 26 feet by 6 feet and is the 21st New York Central barge to be built under the Ellis channel system.

Shipping Board Rejects Offer of Winchester Company to Charter American Merchant Line

THE offer of J. H. Winchester and Company, Inc., agents, 17 Battery place New York City, managing operators of the American Merchant Line for the United States Shipping Board, to charter five steamers of that line on a bareboat basis, has been rejected by the board.

The company offered to pay 45 cents a deadweight ton a month, which would have amounted to about $220,000 a year. The board, under the proposal, would be obliged to take care of insurance and wharfage at New York, two items which alone would have required about $150,000 a year, and be responsible also for repairs that might lead to additional expenses. The five steamships were the *American Banker, American Farmer, American Shipper, American Merchant* and the *American Trader*.

A. S. M. E. to Begin Weekly Engineering Index Service the First of the Year

PLANS have been completed looking to a comprehensive scheme for indexing the engineering literature of the world to be initiated the first of the year, with the new weekly engineering index service of The American Society of Mechanical Engineers.

This task is so extensive as to include the preparation of index items for the 1,500 technical publications of the world appearing in 17 languages in 37 countries which are received in the Engineering Societies Library, (29 West 39th street, New York). The index items will be printed on cards and mailed weekly to the subscribers to the new service. This project was authorized by the A. S. M. E. Council at its St. Louis meeting on October 8, 1927, as an important extension of the Engineering Index in its service to research and the development of industry and to bring to every one not only in the United States but to any in the world the storehouse of knowledge appearing in the technical literature of the world.

The new service will be under the general supervision of the committee on publications of the society, of which Ralph E. Flanders is chairman, and the finance committee, under the chairmanship of N. V. Coes. Professor Carlos deZafra, of New York University, will occupy the post of Director of the Engineering Index.

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Ship Construction and Repair Bids

Reconditioning and New Boilers for Ice Boat Latrobe

BIDS were received and opened on Wednesday, September 28, in Baltimore, Md., for the installation of new boilers and general reconditioning of the iceboat *Latrobe*. The Bethlehem Shipbuilding Corporation, Ltd., Baltimore, Md., submitted a low bid for the work, this bid amounting to $192,994.50. The remaining yards bidding on the work follow:

Name	Price
Theodore Rohde, Inc.	$199,677.00
Speddin Shipbuilding Company, Inc.	230,040.00
Chesapeake and Marine Railway	252,221.25

Bids Received for Converting Three Shipping Board Vessels to Diesel Electric Drive

BIDS opened Monday, October 3, at the offices of Gibbs Brothers, Incorporated, naval architects, for the conversion to Diesel electric drive for the steamships *Courageous, Triumph* and *Defiance* of the Shipping Board fleet were as follows:

Name of Yard	Amount of bids submitted: One ship "Defiance"	Two ships total and each ship "Triumph" and "Defiance"	Three ships total and each ship	Machinery: Engines	Electrical Equipment
Norfolk Navy Yard	$1,128,045	$2,214,011	$3,346,745	De LaVergne (V.B. 6-cylinder)	General Electric
	.....	1,107,006	1,115,582		
Federal Shipbuilding	1,248,000	2,396,000	3,546,000	De LaVergne (V.B. 6-cylinder)	General Electric or Westinghouse (optional)
	.....	1,198,000	1,182,000		
	1,333,000	2,538,000	3,726,000	Busch-Sulzer (8—EE—21)	General Electric or Westinghouse (optional)
	.....	1,269,000	1,242,000		
	1,334,000	2,534,000	3,726,000	New London 4—OR—6-cylinder)	General Electric or Westinghouse (optional)
	.....	1,267,000	1,242,000		
	1,338,000	2,552,000	3,747,000	McIntosh & Seymour 8—B—40-24)	General Electric or Westinghouse (optional)
	.....	1,276,000	1,249,000		
	1,388,000	2,656,000	3,924,000	Busch-Sulzer 6—CE—17)	General Electric or Westinghouse (optional)
	.....	1,328,000	1,308,000		
Boston Navy Yard	"Triumph"	"Triumph" and "Defiance"			
	1,249,895	2,452,954	3,666,428	De LaVergne or Bessemer	General Electric or Westinghouse
	.....	1,226,477	1,222,143		
	1,333,895	2,617,594	3,910,868	McIntosh & Seymour (6-cylinder)	General Electric or Westinghouse
	.....	1,308,797	1,303,623		
Sun Shipbuilding	1,388,000	.....	.....	Bessemer (8-cylinder)	General Electric or Westinghouse
	1,398,000	.....	.....	De LaVergne (6-cylinder)	General Electric or Westinghouse
	1,467,000	.....	.....	Nordberg (5-cylinder)	General Electric or Westinghouse
	1,525,000	.....	.....	Busch-Sulzer	General Electric or Westinghouse
	1,543,400	.....	.....	Ingersoll-Rand 6-cylinder)	General Electric or Westinghouse
	One ship "Triumph"				
Staten Island Shipbuilding	$1,450,000	Bid on one ship only Increase $6,000 for "Defiance" and $15,500 for "Courageous"		De LaVergne	Westinghouse—Add $6,000 for General Electric
	1,500,000			New London or Busch-Sulzer (8-cylinder)	Westinghouse—Add $6,000 for General Electric
	1,510,000			McIntosh and Seymour	Westinghouse—Add $6,000 for General Electric
	1,560,000			Busch-Sulzer (6-cylinder)	Westinghouse—Add $6,000 for General Electric
Bethlehem Shipbuilding	"Triumph"	"Triumph" and Defiance"			
	1,510,000	2,970,000	.....	McIntosh and Seymour	Westinghouse or General Electric
	.....	1,485,000	.....		
	1,560,000	3,070,000	.....	Busch-Sulzer	Westinghouse or General Electric
	.....	1,535,000	.....		
Morse Drydock and Repair	1,553,000	.....	.....	De LaVergne	Westinghouse
Tietjen & Lang Drydock	1,666,156	.....	.....	Bessemer or De LaVergne	Westinghouse or General Electric
	1,724,522	.....	.....	Fulton	Westinghouse or General Electric
	1,728,726	.....	.....	New London	Westinghouse or General Electric
	1,744,083	.....	.....	Nordberg, Busch-Sulzer or McIntosh and Seymour	Westinghouse or General Electric
	1,804,296	.....	.....	Ingersoll-Rand	Westinghouse or General Electric
	1,920,056	.....	.....	Sexton-Seattle	Westinghouse or General Electric

Repair Work on S.S. W. W. Mills Awarded to Robins

TENDERS were received and opened at the office of Frank S. Martin and Son, naval architects, 25 Broadway, New York City, on Tuesday, October 11, covering repair work to the tanker *W. W. Mills*, owned by the Pure Oil Steamship Company, New York. The work includes a general overhaul of all tanks, hull repairs, renewal of rivets, scraping, painting, machinery overhaul and a new tail shaft. A contract for the work was awarded to the Robins Drydock and Repair Company, Brooklyn, New York.

The Robins yard submitted a proposal of $6,450 covering the general repairs to hull and machinery, 60 cents per rivet for re-

NAME	Lump Sum for Machinery and General Overhaul	Price Per Rivet for 20,000 Rivets	New Tail Shaft	Time After Receipt of Tail Shaft
Tietjen and Lang Drydock Company	$7,150	$ .65	$2,540	8
W. and A. Fletcher Company	9,600	1.10	2,150	9
Morse Drydock and Repair Company	9,400	.75	2,400	17
Theodore Crane's Sons Company	9,755	1.75	2,170	26
Todd Drydock,, Engineering and Repair Corporation (Brooklyn)	7,210	.65	2,700	8
Staten Island Shipbuilding Company	8,570	.85	2,650	14
Sun Shipbuilding and Drydock Company	8,535	.80	2,236	10
New York Harbor Drydock Company, Inc.	6,900	1.00 and .80	2,630	8
James Shewan and Sons, Inc.	7,400	.90	2,700	15
Bethlehem Shipbuilding Corporation, Ltd.	9,430	1.00	2,400	15
Newport News Shipbuilding and Drydock Company	9,800	1.12	2,000	12
Todd Shipbuilding and Drydock Company, Inc., (Mobile)	6,600	.65	2,750	8
Alabama Drydock and Shipbuilding Company	9,235	.93	2,280	7
Maryland Drydock Company	8,982	.85 and .90	1,945	7

Due to additional small items, which are not listed above, the total price of the contract as awarded to Robins amounted to approximately $23,000.

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newal of about 20,000 rivets and $2,500 for the installation of a new tail shaft. The time for the actual repair work was given as eight days by Robins. Due to the fact that it will take about three weeks for the new tail shaft to be made ready for installation, the repairs have been postponed until the vessel has made another voyage. She will be drydocked and the work undertaken in about a month's time. Other proposals submitted are given on page 649.

Bids for Lighthouse Tender Rejected

The bid of $4,850 for the United States lighthouse tender *Madrona*, made by the Crowley Launch and Tugboat Company, San Francisco, California, has been rejected by federal officials. New bids will be received at San Francisco until November 11.

Low Bid for Repairs to S.S. Circinus Amounts to $188,888

A CONTRACT for repairs to the steamship *Circinus*, which went ashore at Descanso Bay, Mexico, on September 21, has been awarded to the San Francisco plant of the Bethlehem Shipbuilding Corporation, Ltd., at a price of $188,888 and a time of 70 days. The vessel is owned and operated by the Plane Line, Inc., 39 Cortlandt street, New York. Other tenders received for the work were as follows:

NAME OF BIDDER	PRICE	DAYS
Todd Drydocks, Inc., Seattle, Wash.	$227,000	79
Moore Shipbuilding Company, Oakland, Cal.	265,000	90
Hanlon Drydock and Shipbuilding Company, Oakland, Cal.	317,000	120

San Pedro Harbor Work

To co-operate with naval officials, the San Pedro Harbor Commission has authorized the drawing of specifications for the dredging of the battle fleet anchorage. The cost of the work was estimated at $25,000.

World's Shipbuilding Continues to Increase

MORE than three million gross tons of merchant vessels are now under construction in the world's shipyards, says a statement just issued by Lloyd's Register of Shipping, based on returns from all maritime countries for the quarter ended September 30, last. This represents an increase of about 234,000 gross tons over the total at the end of the previous quarter, and of nearly a million and a quarter tons over the aggregate building at the end of September, 1926. The present total is less than 100,000 gross tons below the pre-war figure of June 30, 1914.

Chief factors in the growth shown during the past quarter were Great Britain and Ireland, with an increase of 146,000 gross tons, and Germany with 108,000 tons. Denmark, Sweden and Russia also showed gains; but declines were registered for the other maritime countries, including the United States, which is now building over 50,000 tons less than at June 30 last. Great Britain and Ireland are now constructing within a thousand tons of as much merchant shipping as all the other countries combined, while the American share of the world total is only about 3 percent. German construction represents 16 percent. Several changes in the construction ranking of the shipbuilding nations have taken place during the quarter just ended, although the leaders' positions remain unchanged, Great Britain and Ireland, Germany, Italy and Holland, leading in the same order as at the end of June, although Italy has about 18,000 gross tons less in hand than in June, and Holland about 8,000. The United States, which stood fifth in the previous quarter, is now seventh, having been passed by France and Denmark, the former of which showed a decline of about 5,000 tons from the June figure, and the latter a gain of about 17,000 tons. Sweden, with an increase of about 28,000 tons, and Russia, with a 5,000 tons gain are eighth and ninth respectively, each only 10,000 tons behind the American total.

A continued excess of new work begun over tonnage sent down the ways is shown by the returns for the past quarter. Although the replacements in Great Britain and Ireland were only 15,000 gross tons in excess of the shipping launched, the gap between tonnage being sent towards completion and new work in the other maritime countries combined was 218,000 gross tons; reversing conditions in the June quarter, when Britain and Ireland's yards began work on 168,000 tons more than was launched, and the other countries only 40,000 tons. A year ago, at the end of the September, 1926, quarter, however, the returns showed that Great Britain and Ireland had only 68,000 tons of new work, compared with 208,000 tons of launchings; while other nations took on 200,000 tons of fresh orders, and launched 178,000 tons.

That the tendency towards an increasing production of tankers is continuing is shown by Lloyd's returns; the quarter ending September 30 last showing a gain of 50,000 gross tons over the previous one, the total being 775,632 gross tons. For Great Britain and Ireland, a slight gain was shown, and for the United States a small decrease, practically all the advance being made by the other countries. How sharp the extension of tanker construction has been during the past year is seen by a comparison with the figures for the quarter ending September 30, 1926, when the world total was only 251,000 gross tons, of which Great Britain and Ireland were building 87,000 tons, the United States, 10,000 tons and all other countries combined, 154,000 tons.

Motor vessel construction is again a feature of Lloyd's returns, a gain of about 130,000 gross tons being shown by the new figures, following the very sharp advance of almost 300,000 tons in the quarter ended June 30. Over 700,000 tons more of ships equipped with internal combustion engines are now in hand than there was at this time last year, when the total for all countries, being constructed, was 869,000 tons. During the quarter just ended, Germany's motorships on order showed an increase of 58,000 tons, compared with one of 25,000 tons for Great Britain and Ireland, and of about 45,000 tons for the other maritime nations.

More than half of the present shipbuilding of the world is being devoted to motor vessels, the total of 1,589,000, comparing with that of 1,485,000 gross tons for all other types of vessels combined. Of the present motorship construction, 41 percent is now being done in the yards of Great Britain and Ireland; 15 percent in Germany, and 44 percent by the other shipbuilding countries taken together.

The continuing trend towards motor propulsion is also indicated in Lloyd's returns of the power of various types of marine engines being built or installed throughout the world, the figures for oil engines showing an advance during the last quarter, while those for reciprocating engines and steam turbines declined.

The total indicated horsepower of the oil engines reported for the quarter ended September 30, was 1,163,630, of which 356,440 was the figure for Great Britain and Ireland, and 807,190 for the other maritime countries. At the end of the June quarter the total for the world was given as 1,102,424. Of the current figure of 1,163,630, Germany alone has 244,370.

For steam reciprocating engines, the present world total of 568,969 indicated horsepower represents a decline from the June quarter figure, which was 580,600. The British and Irish share of the aggregate for the September quarter was 394,224, as compared with 174,745 for the other countries.

For steam turbines, the shaft horsepower reported at the end of the September quarter was 309,900, against 338,050 for the previous quarter. German figures are omitted in both cases, not being available. The share of Great Britain and Ireland in the quarter just ended was 193,800, in comparison with 116,100 for other nations.

Contrasting the shipbuilding situation in the various maritime nations as compared with a year ago, Lloyd's Register points out that Germany has quadrupled its work in hand, and England almost doubled its September, 1926, figure. During the year, Germany has advanced from fifth to second place, the United States has dropped from sixth to seventh, and other changes have occurred. All countries but Italy, France and the United States have more tonnage building than they did a year ago.

GREAT LAKES NOTES

Manitowoc Shipyard to Build Two Steel Barges for the United States Engineers

A CONTRACT for the construction of two steel barges has been awarded to the Manitowoc Shipbuilding Corporation, Manitowoc, Wis., by the United States Engineer Office, Milwaukee, Wis. The Manitowoc Corporation submitted a price of $23,330 for plant construction and $20,140 for channel construction. Bids for the work were received and opened at Milwaukee on September 13.

Great Lakes Repairs

THE lake freighter *I. L. Elwood* hit a pier at South Chicago, was damaged forward and went to a shipyard for repairs.

The steamship *Donnaconna* has been drydocked at Port Arthur and it will take about two weeks to make the necessary repairs.

The steamship *J. E. Gorman* has been drydocked at Superior for repairs.

The steamship *J. F. Taylor* has been docked at Collinwood, Ohio, for repairs.

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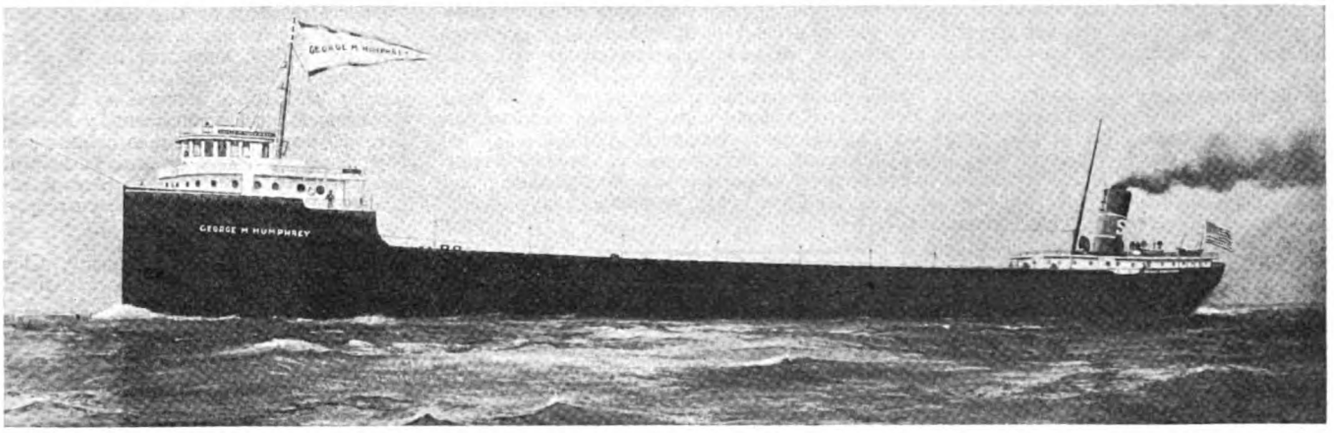

New 600-foot bulk freighter added to the fleet of the Kinsman Transit Company, Cleveland, O., this year. The "George M. Humphrey" was built by the American Shipbuilding Company at its Lorain yard

New Buffalo Piers Completed

THE first of the two new piers at the foot of Michigan avenue, Buffalo, in the extensive plans for harbor improvements in that city, was completed October 1. The second one was completed before the last of October. The north pier is now in readiness for from 16 to 18 vessels, according to the mooring rules that will be enforced by the representatives of the underwriters, but it is probable that the pier will not be used until winter storage of the grain fleet begins.

Vessel Crews Saving More Money This Year

THAT sailors on the Great Lakes are thrifty is shown by the large increase of deposits by vessel crews in the Guardian Trust Company of Cleveland over a year ago.

On September 1, 1926, the standing of the leading boats showed that there were two vessels whose crews had total deposits of $10,000 or more, one that had deposited $9,000 and four more that had deposits of $8,000.

The standing, as of September 1, this year, shows six ships with deposits of $10,000, four others with deposits of $9,000, and still four others with deposits of $8,000. In other words, the record stands fourteen ships in the very select list this year as against seven in 1926, and this very clearly points out the increasingly large wage-saving campaign which the masters in the Cleveland Cliffs, Hanna and Oakes fleet are carrying out this season.

Radio Increases Safety Along the Great Lakes

SAFETY in navigation on the Great Lakes is rapidly increasing. Nine Kolster radio compasses have been ordered from the Federal Telegraph Company by Herbert K. Oakes of Cleveland, a prominent Great Lakes shipowner, to be installed on vessels under his control. The decision to equip his fleet with these safeguards is the result of trying two Kolster compasses on his ships during the past few months.

Four new radio beacons, which automatically send bearings from shore to the radio compasses on vessels, have been placed in operation on Lake Michigan by the United States Government during the past month, making a total of 15 beacons now in use on the Great Lakes. Three more are under construction and still others are being planned by the Bureau of Lighthouses. The United States has more radio beacons now in service along its coasts than all other countries combined. Dr. F. A. Kolster, the designer of the radio compass, founded the government's radio laboratory in 1912 and was its chief for 10 years.

Six of the new compasses are to be installed on the ore-carrying vessels of the Bethlehem Transportation Corporation, one is for the Franklin Steamship Company and two for the Cambria Steamship Company.

TRADE PUBLICATIONS

"BRASS TACKS."—The first issue of a new publication of the Bridgeport Brass Company, Bridgeport, Conn., has made its appearance. The publication is devoted to the story of the products of this company which reach practically every line of industrial activity.

BATTERY-CHARGING EQUIPMENT — A technical description of apparatus for charging storage batteries has been prepared by the General Electric Company and appears in pamphlet form. The equipment is mainly for use in connection with industrial electric trucks. Details are given of control panels, generator panels, resistance panels and the like.

HOIST AND DERRICK INSTALLATIONS.—The application of Clyde hoist and derrick equipment in various industries where handling materials is an essential feature has been described in a booklet recently issued by the Clyde Iron Works Sales Company, Duluth, Minn. The marine installations illustrated in this catalogue include a hydraulic dredge, a sand dredge and barge equipment.

TURBINES FOR MECHANICAL DRIVE.—In a recent bulletin the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes turbines for mechanical drive in capacities from 5 to 750 brake horsepower. The equipment is suited for driving circulating pumps, centrifugal boiler feed pumps, blowers and other rotary apparatus either directly or through the medium of reduction gears.

BESSEMER DIESEL ENGINES.—The Bessemer Gas Engine Company, Grove City, Pa., manufacturers of Diesel marine engines, has just issued a catalogue descriptive of the various types and uses of engines produced by the company. The catalogue is illustrated throughout with installation views of numerous vessels equipped with Bessemer engines and contains complete specifications and construction data for them.

MAXIM SILENCERS.—The application of the Maxim silencer to industrial uses has been made the subject of a catalogue issued by the Maxim Silencer Company, Hartford, Conn. In marine work the principal application of the silencer has been on Diesel powered ships. It is also used on reciprocating vacuum pump dischargers, gasoline engine exhausts and for air compressor work. In this bulletin each of the applications is discussed briefly in a nontechnical manner.

THE DUPONT MAGAZINE.—The anniversary number of *The Dupont Magazine*, which contains interesting facts about the history, development and growth of the E. I. du Pont de Nemours & Company, Inc., during the past 125 years, has recently been published. Many of the products manufactured by this organization are used in the marine field and such portions of the magazine as apply to these products should have a wide interest among our readers.

JEFFERY'S MARINE GLUES.—For the benefit of users of marine glue the L. W. Ferdinand & Company, Boston, Mass., has prepared a small booklet describing the various applications and uses to which Jeffery's marine glue can be put. Among other subjects covered by the booklet are the methods of preparing and applying this glue to the decks of vessels of all types, the method of laying canvas on decks, the use of liquid glue cement for repair and general use, for joiner work, hollow spars and veneers as well as its use for waterproofing fabrics and for sealing gaskets, crank cases and cylinder heads.

WORLD CRUISE OF THE WARRIOR.—The firm of Cox & Stevens, naval architects, New York, has taken an unusual method of presenting the story of a Diesel yacht, the *Warrior*, which was designed and built by the Krupp Works at Kiel, Germany, in 1924. Paul D. Cravath, a guest of the owner, Harrison Williams, on a world cruise undertook to write the story which has been published in booklet form by Cox & Stevens. This yacht, which has a length of 240 feet and is equipped with Diesel engine power, has aboard every conceivable device for comfort and safety and represents the highest development of luxurious ocean travel.

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PULVERIZERS.—The Bethlehem Steel Company, Bethlehem, Pa., has issued catalogue "J" containing illustrated descriptions of various types of pulverizing equipment manufactured by this company. At this time when a considerable amount of interest is being shown in the matter of pulverized coal burning equipment on board vessels descriptions of equipment of the type of the Bethlehem pulverizer will have a wide appeal. The catalogue includes details of operation and construction of the pulverizer which is of the dry grinding table roller type and can be used for grinding dry materials of any character up to a fineness of 325 mesh.

DIESEL ELECTRIC MARINE INSTALLATIONS.—A complete catalogue of Diesel electric marine installations made by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has been issued to the industry. The publication is devoted exclusively to this type of propulsion and auxiliary equipment for ships. Twenty-one typical installations are shown in colored views and 19 of these are accompanied by blue prints showing the plan and elevation of each engine room arrangement. There are also two pages of text briefly enumerating the advantages of this type of propulsion and a double page spread of illustrations of auxiliary equipment. The object in publishing this booklet, as announced by the company, has been to appeal to every one either working on or interested in ships from the tug boat engineer to the wealthy yacht owner.

CHART FOR FORGED STEEL FLANGE DESIGN.—A valuable aid to the engineer or draftsman concerned with the design of forged steel flanges for piping, tubing, pressure vessels, tanks, etc., has recently been published by the American Spiral Pipe Works in the form of a set of charts which enable a graphical solution of the new Waters formula for the design of any plain or hub flange from 4 to 100 inches in diameter. Several years ago the American Spiral Pipe Works undertook a series of tests to determine the actual strength of flanges of various shapes. Professor E. O. Waters of Yale University who was associated with the test developed a formula which checked accurately with the results obtained on the testing machines. The results of this work were made public at the Mid-May meeting of the A.S.M.E. at which Professor E. O. Waters and Mr. J. Hall Taylor presented a paper reviewing past methods, setting forth the new formula developed by Professor Waters and the results of the experimental work undertaken by Mr. Taylor. The tests which had been conducted during 1924 and 1926 included flanges of both standard and special design. These tests afforded a complete check on the correctness of the formula and developed considerable data on the effect of hubs on the strength of flanges. Due to the fact that a great number of variables are present in flange design the formula evolved was necessarily complicated. To overcome this difficulty the American Spiral Pipe Works prepared a series of graphical charts from which by direct reading the stresses in flanges may be determined without necessity for mathematical solution of the complicated formula. The charts are in two sections, the first covering plain ring flanges from 4 to 40 and from 40 to 100 inches in diameter. The second section covers stresses in high or low hub forged steel flanges from 4 to 100 inches. The charts have been published in easily usable form and are available to engineers by addressing the Taylor Forge Division, American Spiral Pipe Works, Box 485, Chicago, Illinois. A reprint of the paper presented at the Mid-May meeting of the A.S.M.E. by Professor Waters and Mr. Taylor and which contains complete results of their investigations with detailed explanation of the data developed and methods used in conducting tests as well as the recommended proportions for both flat ring and hub flanges is also available.

BUSINESS NOTES

T. Latimer Ford, for the past four or five years in charge of the Pacific coast territory of the American Hammered Piston Ring Company, Baltimore, Md., has been elected vice president of the company.

The Roosevelt Steamship Company, Inc., operating the American India and Atlantic Australian Lines for the United States Shipping Board, has moved its offices from 16 Beaver street to the fourth floor front at 11 Broadway, New York.

H. R. Harris, 1123 Metropolitan Life Building, Minneapolis, Minnesota, has just been appointed as representative of The Falk Corporation of Milwaukee, Winconsin, manufacturers of herringbone gears, speed reducers and flexible couplings. Mr. Harris will cover the state of Minnesota and also Douglas County, Wisconsin.

Orders received by the General Electric Company for the three months ended September 30, 1927, amounted to $77,420,263, compared with $81,587,917 for the third quarter of 1926, a decrease of 5 percent, according to an announcement by President Gerard Swope. For the nine months ended September 30, orders totalled $233,076,091, representing a decrease of 6 percent compared with $246,993,637 in the corresponding nine months of 1926.

The Winton Engine Company, Cleveland, Ohio, has established an eastern sales and service office in charge of Mr. A. G. Griese, at 331 Madison Avenue, New York City. As a direct branch of the factory, this office will supervise the sales and service of Winton gasoline and Diesel engines as well as auxiliary equipment on the entire east coast. Mr. Griese is assisted by Mr. F. C. Erdman, Mr. T. L. Meckbach and Mr. H. V. Haymann.

The Air Reduction Company, Inc., 342 Madison Avenue, New York, has purchased the oxygen plant, equipment, and entire business of the New England Compressed Gas Company, Boston, Mass. With this new purchase the Air Reduction Company, Inc., and the Air Reduction Sales Company command the production and distribution facilities of thirty-five oxygen plants, all located in or near the industrial centers of the United States.

The International Shipmasters' Association has moved from the Commercial National Bank building to the Perry-Payne building, Cleveland, Ohio.

Marine Societies

America

American Marine Association. 30 Church St., New York. President—Col. E. A. Simmons.

American Marine Standards Committee. Chairman, Colonel E. A. Simmons. Secretary, A. V. Bouillon, Division of Simplified Practice, Department of Commerce, Washington, D. C.

American Society of Marine Designers. Secretary—B. G. Barnes, 202 Kendrick Ave., Quincy, Mass.

American Society of Marine Engineers. 605 Market St., San Francisco, Calif. President—Henry F. Gelhaus. Secretary—Wm. H. Thille.

American Society of Naval Engineers. Navy Department, Washington, D. C. Secretary-Treasurer—Commander H. B. Hird, U. S. N., Bureau of Engineering, Navy Department, Washington, D. C.

American Steamship Owners' Association. 11 Broadway, New York. President—H. B. Walker.

Atlantic Coast Shipbuilders' Association. 1600 Walnut Street, Philadelphia, Pa. Secretary—C. S. King.

Council of American Shipbuilders, Inc., 50 Broadway, New York. President—Homer L. Ferguson. Secretary-Treasurer—Henry C. Hunter.

Jersey Marine Club, 4th and River streets, Hoboken, N. J. President—Col. Bartlett.

Lake Carriers' Association. President—J. S. Ashley. Secretary—George A. Marr, Rockefeller Building, Cleveland, O.

National Association of Engine and Boat Manufacturers. 29 West 39th Street, New York City. Secretary—Ira Hand.

National Association of Masters, Mates and Pilots. National Secretary—M. D. Tennis-wood, 308 Vine St., Camden, N. J.

National Marine Engineers' Beneficial Association. Headquarters, 311-315 Machinists Building, Washington, D. C. President—Wm. F. Yates. Secretary—Albert L. Jones.

National Merchant Marine Association. Munsey Bldg., Washington, D. C. President—Hon. J. E. Ransdell.

Neptune Association. 21 Pearl St., New York City. Secretary-Treasurer—Captain John F. Milliken.

New York and New Jersey Dry Dock Association, 111 Broadway, New York. President—Jonathan Moore.

Ocean Association of Marine Engineers. 15 Whitehall St., New York. Secretary—Bert L. Todd.

Port of New York Authority. 75 West Street, New York. Chairman—George S. Silzer. Secretary—Wilson J. Vance.

Society of Naval Architects and Marine Engineers. 29 West 39th Street, New York. Secretary and Treasurer—Daniel H. Cox.

The Maritime Association of the Port of New York. 78 Broad St., New York City. President—John Dowd. Secretary—John F. Manning.

The New York Tow Boat Exchange. 11 Moore St., New York. Manager—Langdon W. Smith.

The Propeller Club of the Port of New York. President—Harry W. Parsons, 111 Broadway, New York. Secretary—W. Z. Gardner, 136 Liberty street, New York.

United States Naval Institute. Naval Academy, Annapolis, Md. Secretary and Treasurer—Captain H. A. Baldridge, U. S. N.

United States Ship Operators' Association. 149 Broadway, New York. President—Winchester Noyes.

Canada

Grand Council N. A. of M. E. of Canada. Grand Secretary-Treasurer—W. A. MacDonald, 62 Albert St., Halifax, N. S.

Great Britain

Institute of Marine Engineers, Incorporated. 85/88 The Minories, London, E.1.

Institution of Engineers and Shipbuilders in Scotland. 39 Elmbank Crescent, Glasgow.

Institution of Naval Architects. 5 Adelphi Terrace, London, W. C.

North East Coast Institution of Engineers and Shipbuilders. Bolbec Hall, Westgate Road, Newcastle-on-Tyne.

France

Association Technique Maritime et Aéronautique. Secrétariat Genéral—7, rue de Madrid, Paris (8e).

Italy

Collegio Degli Ingegneri Naval e Meccanici in Italia.

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